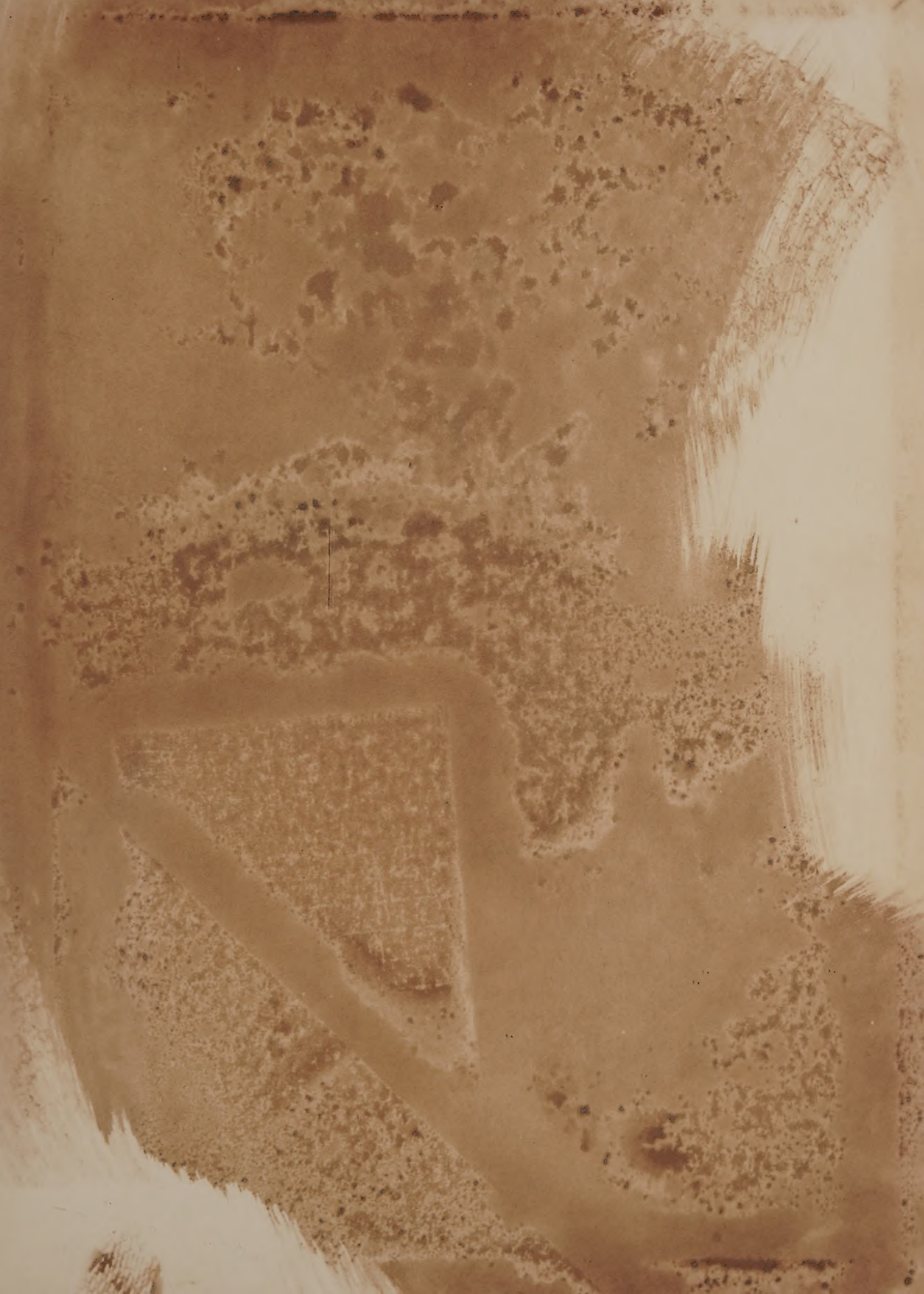
EXPEDITION REPORTS
Q115
G7
V. 1, pt. 1
Discovery Repts.
1920-1959
V. 1, pt. 1,1575
DATE
ISSUED TO
EXPEDITION REPORTS
Q115
G7
V. 1, pt. 1
Discovery Reports
1920-1959
V.1, pt. 1, 1575
LIBRARY
BUREAU OF COMMERCIAL FISHERIES
U. S. FISH AND WILDLIFE SERVICE
P. O. BOX 3830



DISCOVERY REPORTS

Issued by the Discovery Committee
Colonial Office, London
on behalf of the Government of the Dependencies
of the Falkland Islands

VOLUME I

OCT 1955
LIBRARY
FOFI
FISH & WILDLIFE
SERVICE

Q115.67
V.1, pt.1

1575

CAMBRIDGE
AT THE UNIVERSITY PRESS
1929

PRINTED IN GREAT BRITAIN

CONTENTS

LIST OF PERSONNEL . . . . . *page* vii

PREFACE ix

CORRIGENDA xiii

STATION LIST 1925–1927 (published 6th February, 1929)

Introduction 3

R.R.S. 'Discovery', Stations 1–299 6

R.S.S. 'William Scoresby', Stations WS 1–136 92

Marine Biological Station, South Georgia, Stations MS 1–82 132

Summarised List of Stations 138

Plates I–VI . . . . . *following page* 140

OBJECTS, EQUIPMENT & METHODS (published 10th July, 1929)
By S. Kemp, Sc.D., A. C. Hardy, M.A. and N. A. Mackintosh, A.R.C.S., M.Sc.

Part I. The Objects of the Investigations . . . . . *page* 143

Part II. The Ships, their Equipment and the Methods used in Research 151

Part III. The Marine Biological Station 223

Index 231

Plates VII–XVIII . . . . . *following page* 232

THE NATURAL HISTORY OF THE ELEPHANT SEAL WITH NOTES ON OTHER SEALS FOUND AT SOUTH GEORGIA (published 31st July, 1929)
By L. Harrison Matthews, M.A.

The Natural History of the Elephant Seal . . . . . *page* 235

Bibliography of the Elephant Seal 249

Notes on Other Seals Found at South Georgia 252

Plates XIX–XXIV . . . . . *following page* 255

SOUTHERN BLUE AND FIN WHALES (published 12th December, 1929)
By N. A. Mackintosh, A.R.C.S., M.Sc. & J. F. G. Wheeler, M.Sc.

Introduction . . . . . *page* 259

External Characters 271

Food, Blubber and External Parasites 360

The Reproductive Organs 379

Breeding and Growth 412

The Stock of Whales 453

Summary 467

List of Literature Cited 470

Appendices 472

Index 537

Plates XXV–XLIV . . . . . *following page* 540

PARASITIC NEMATODA AND ACANTHOCEPHALA COLLECTED IN 1925–1927 (published 23rd December, 1929)

By H. A. Baylis, M.A., D.Sc.

NEMATODA . . . . . *page* 543

ACANTHOCEPHALA 555

THE BIRDS OF SOUTH GEORGIA (published 23rd December, 1929)

By L. Harrison Matthews, M.A.

THE BIRDS OF SOUTH GEORGIA . . . . . *page* 563

BIBLIOGRAPHY OF LITERATURE RELATING TO THE BIRDS OF SOUTH GEORGIA 592

PLATES XLV–LVI . . . . . *following page* 592

LIST OF PERSONNEL

DISCOVERY COMMITTEE

E. R. Darnley, M.A., B.Sc. (*Chairman*), Colonial Office
Sir S. F. Harmer, K.B.E., Sc.D., F.R.S. (*Vice-Chairman*), British Museum
H. T. Allen (*Finance Member*), Colonial Office
J. O. Borley, O.B.E., M.A. (*Fisheries Adviser*), Colonial Office
Rear-Admiral H. P. Douglas, C.B., C.M.G., Admiralty
Sir J. Fortescue Flannery, Bt., M.I.C.E. (*Consulting Naval Architect*)
H. G. Maurice, C.B., Ministry of Agriculture and Fisheries
J. M. Wordie, M.A., Royal Geographical Society

Former Members

Rear-Admiral R. W. Glennie, C.M.G.
Sir J. Middleton, K.B.E., C.M.G.
Captain J. D. Nares, D.S.O., R.N.

Secretary: E. Baynes, O.B.E., 1923–1925
S. R. Pughe, M.B.E., 1928
A. L. Ayton, 1925–1928
F. H. Harper, M.B.E., 1928–

Naval Architect: A. Harker, M.I.N.A., F.C.M.S. (of Messrs Flannery, Baggallay and Johnson, Ltd., Consulting Engineers), 1923–

Technical Officer: H. Horsburgh, A.M.I.C.E., Crown Agents for the Colonies, 1923–

Shipping Officer: E. A. Nattriss, Crown Agents for the Colonies, 1927–

Accounting Staff: R. A. Brown, 1925–1928.
T. J. Hardy, 1927–1928.
E. W. A. Scarlett, 1928–
C. G. W. Lawrence, 1928.
S. W. Smith, 1928–

Clerical Assistants: Miss E. Showell, 1923–1928
Miss B. M. H. Borley, 1928–
Miss M. E. Jeffries, 1928–
Miss D. B. Meggitt, 1929–

SCIENTIFIC STAFF

Director of Research

S. Kemp, Sc.D., 1924–

Zoological Staff

A. C. Hardy, M.A., 1924–1928
N. A. Mackintosh, A.R.C.S., M.Sc., 1924–
J. E. Hamilton, M.Sc., 1924–
J. F. G. Wheeler, M.Sc., 1924–
L. H. Matthews, M.A., 1924–1927
E. R. Gunther, M.A., 1924–
D. D. John, M.Sc., 1925–
F. C. Fraser, B.Sc., 1925–
J. W. S. Marr, M.A., B.Sc., *1927–
G. W. Rayner, B.Sc., 1927–
T. J. Hart, B.Sc., 1929–
F. D. Ommaney, B.Sc., 1929–
A. H. Laurie, B.A., 1929–

Hydrological Staff

H. F. P. Herdman, M.Sc., 1924–
A. J. Clowes, A.R.C.S., M.Sc., 1924–
G. E. R. Deacon, B.Sc., 1927–

Curators: Miss H. E. Bargmann, Ph.D., 1928–
Mrs M. E. White, Ph.D., 1929–

Clerical Assistant: Miss S. Isaacson, 1924–

* Seconded for service with the British, Australian, New Zealand Antarctic Expedition, August, 1929.

MARINE EXECUTIVE STAFF

(Principal Officers only)

Comdr. W. M. Carey, R.N. (Retd.), Executive officer in command. Captain R.R.S. 'Discovery II' 1929–

Comdr. J. R. Stenhouse, D.S.O., O.B.E., D.S.C., R.N.R., Executive officer in command. Captain R.R.S. 'Discovery' 1923–1928

Lt.-Comdr. R. L. V. Shannon, R.N. (Retd.), Captain R.R.S. 'William Scoresby' 1927–

Lt-Comdr. G. M. Mercer, D.S.C., R.D., R.N.R., Captain R.R.S. 'William Scoresby' 1925–1927

Lt.-Comdr. J. M. Chaplin, R.N., Second and Chief Officer R.R.S. 'Discovery' 1925–1927; detached for survey duties 1928–

Lt.-Comdr. J. C. C. Irving, R.N. (Retd.), Chief Officer R.R.S. 'Discovery II' 1929–

C. A. Milward, Chief Officer R.R.S. 'William Scoresby' 1929–

A. Irving, Chief Officer R.R.S. 'William Scoresby' 1926–1927

Lieut. A. L. Nelson, R.N.R., Second Officer R.R.S. 'Discovery II' 1929–

T. W. Goodchild, Third and Second Officer R.R.S. 'Discovery' 1925–1928

J. G. Bowers, Second Officer R.R.S. 'William Scoresby' 1929–

Lieut. M. C. Lester, R.N.R., Second Officer R.R.S. 'William Scoresby' 1926–1927; *Chief Officer* 1928–1929

Lieut. R. A. B. Ardley, R.N.R., Third Officer 'Discovery II' 1929–

Lieut. C. Sanderson, R.N. (Retd.), Third Officer R.R.S. 'Discovery' 1926–1927

F. E. C. Davies, Acting Second and First Officer R.R.S. 'William Scoresby' 1927–1929; Fourth Officer R.R.S. 'Discovery II' 1929–

W. P. O'Connor, Assistant for survey duties 1928–

Eng. Lieut.-Comdr. W. A. Horton, R.N. (Retd.), Principal Marine Engineer. Chief Engineer R.R.S. 'Discovery' 1925–1927; R.R.S. 'Discovery II' 1929–

Eng. Lieut. D. Roy, R.N. (Retd.), Chief Engineer R.R.S. 'William Scoresby' 1927–

J. W. Ridley, Chief Engineer R.R.S. 'William Scoresby' 1926–1927

A. N. Porteous, Second Engineer R.R.S. 'Discovery' 1925–1927; Second Engineer R.R.S. 'Discovery II' 1929–

G. S. Hunter, R.N. (Retd.), Second Engineer R.R.S. 'William Scoresby' 1927–

G. Brabender, Second Engineer R.R.S. 'William Scoresby' 1926–1927

R. Gourlay, Artificer-Engineer R.R.S. 'Discovery' 1925–1927; Third Engineer R.R.S. 'Discovery II' 1929–

E. H. Marshall, D.S.O., M.R.C.S., L.R.C.P., Surgeon 1924–

PREFACE

WHALING operations by modern methods began in the Dependencies of the Falkland Islands in 1904 and rapidly developed. By 1912–13 the number of the small steamships known as whale catchers which were employed had risen to twenty-one in South Georgia, and thirty-two in the South Shetlands. The whaling industry in the Dependencies had become the largest in the world, a position which it still retains. From 1909–10 to 1917–18, over three million barrels of whale oil were produced, valued at over £20,000,000. In the ensuing years the industry underwent a remarkable development, and in the single season 1928–29 the output was 1,047,000 barrels valued at £5,513,000.

Almost from the beginning the Government of the Falkland Islands exercised control over the industry by means of a system of leases and licenses, which was given legal form in the Whale Fishery Ordinance, 1908. The primary object of such control was to regulate the use of Crown lands, harbours and territorial waters by the whalers. It was not long, however, before there were complaints that the whalers utilised only the blubber and abandoned the remainder of the carcases. As the industry grew, apprehensions were expressed that such intensive pursuit threatened the maintenance of the stock of whales. These apprehensions were strongly reinforced by the lessons of whaling history, which abounds in examples of the destruction of whaling industries in particular localities through over-fishing. Accordingly the Colonial Government sought to employ its control to effect the prevention of waste and the protection of the stock of whales.

The first problem, that of the prevention of waste, at that time presented no difficulties except those of enforcement and of reasonable adaptation to commercial possibilities and requirements, and waste was in fact reduced within narrow limits during a long period. But there has now developed a type of whaling not amenable to control, to which reference is made below.

When the Colonial Government approached the second problem, that of the protection of the stock, it soon became evident that the biological knowledge required for scientific control was almost totally lacking and could not be acquired except by means of costly and prolonged investigations conceived on broad lines. Existing knowledge of the specific differences of whales was not inconsiderable, but was inadequate in important respects; in particular

the question whether southern Blue and Fin whales were distinguishable from the northern forms was still unsettled. Very little was certainly known about the breeding habits, migrations, rate of growth, length of life or food of the whales hunted in the Dependencies. No indication could be given regarding the probable amount of the annual increase of a particular species, and consequently it was impossible to estimate the number of whales which might be taken annually without diminishing the stock.

It was clear that no really scientific solution of the problem could be obtained for many years. In the meantime the Colonial Government could only have recourse to an empirical restriction of the pursuit of whales, based on the statistics of catch and the opinions of scientific men and practical whalers, and exercised mainly by means of a limitation of the number of licensed whale catchers, and to some extent by prohibition of the hunting of species which seemed especially endangered.

Before the War the question of the researches required to place control on a scientific footing began to engage attention, and as a preliminary step the late Major G. E. H. Barrett-Hamilton was employed during the Southern summer of 1913–14 to make anatomical investigations of the carcases of whales at the whaling stations in South Georgia. Major Barrett-Hamilton died at his post, and nothing further could be done until near the conclusion of the War. A Committee, the Inter-Departmental Committee on Research and Development in the Dependencies of the Falkland Islands, was then appointed to consider not only the preservation of the whaling industry, but also other industries actual or potential, and in particular a scheme for the employment of a research vessel mainly in the study of whales. The Committee's report was published in 1920, and the *Discovery* investigations are the outcome of that report.

In the study of Blue and Fin whales considerable progress has already been made, and though the age which these species attain is still a matter of conjecture, the principal features of their life history up to sexual maturity have been ascertained, while measures have been taken to decide whether the northern and southern stocks are specifically or racially distinguishable. These investigations are obviously essential to the enquiry, and there are others no less important. The industry in the South Atlantic suffers from marked annual fluctuations: these are bound up with the extensive migrations which the whales are known to undertake and, it may safely be assumed, are governed by alterations in the food supply and other factors in their en-

vironment. To trace the reasons for these fluctuations is a fundamental part of the work. It involves a study of the migrations of whales, of their food, and of the conditions which affect its abundance; a study of the minute plants on which all animal life in the sea, including whale life, ultimately depends; and a study of the physical constitution and movements of the water. Such investigations will undoubtedly have as much importance in enquiries into southern whaling as they have been shown to possess in northern fishery problems. They all converge upon the central problem of estimating the number of whales of each species which may be taken annually without depleting the stock.

Meanwhile changes have occurred in the conduct of the industry which have materially affected the administrative position. Until the last few years whaling could not be carried on without the use of harbours and territorial waters. Control by the Colonial Government was thus made feasible and was in fact effectual. The whaling companies have now, however, introduced methods which enable the utilisation of whales to be carried on in the open sea without the use of territorial waters. This kind of whaling is commonly described as pelagic whaling, and is carried out upon a scale already large and still increasing. Such whaling is of course beyond the jurisdiction of the Colonial Government, and the natural effect of its growth is that the problem of the control of whaling in the Dependencies has outgrown the sphere of the local Government and entered that of international affairs. The need for the information which the investigations seek to obtain has not been diminished, but has indeed increased proportionately with the increased destruction of whales. It should be realised, however, that the machinery of international agreement is much more cumbrous than that of action by the local Government, and that the difficulties of utilising the results obtained will be correspondingly augmented.

The *Discovery* investigations are concerned not only with whaling, but, so far as their resources permit, with all economic questions arising in the Dependencies. Apart from whaling, the principal subjects in which work is being carried on are those of marine survey, sealing and fisheries. In the immense area of the Dependencies there is an enormous amount of marine survey work remaining to be done, and such work is being undertaken as far as the means at the Committee's disposal allow. At present the more active work of this department is confined to South Georgia, but visits have already been made to the South Shetlands and work has been begun in that area. The

records of marine casualties emphasize the need for such work and the regions at present under survey are those which are of particular importance for the navigation of whaling vessels.

In regard to sealing, work is being done upon the fur-seal rookeries of the Falkland Islands, and the stocks of elephant-seals in South Georgia. The former now promise well for the future, and the latter are under conservative management and have been the subject of a profitable industry for a number of years.

Some preliminary work has been done on fisheries, but no ground of special promise has yet been discovered.

The main objects of the investigation are economic and it is to the economic aspect of the work that the energies of the scientific staff are primarily directed. But the wide scope of the enquiry affords opportunity for many observations whose value, in the present state of our knowledge, would seem to be purely scientific. Such work, undertaken without ulterior motive, has in the past often yielded results of the highest economic importance, and has therefore been given a place in the general plan of operations; it is undertaken, however, only when it involves no interference with the economic programme. The Committee is indebted to a number of specialists in different branches of marine science for assistance in the preparation of results, and their papers, some of which will be of purely scientific interest, will be published with the others.

It may be added that many of the reports which follow are records of work still in progress, and that in some cases they may need modification in the light of further experience.

ROWLAND DARNLEY

January 1930

CORRIGENDA

p. 9, St. **9**, Depth 1000 m., S °/₀₀, *for* 34·29 *read* 34·47
Depth 1000 m., *σt*, *for* 27·37 *read* 27·52
p. 31, St. **96**, **N 70 V**, Time, Hauled, *for* 0845 *read* 1015
p. 35, St. **102**, **N 100 H**, 52 m., Time, Hauled, *for* 1324 *read* 1317
N 100 H, 104 m., Time, Hauled, *for* 1325 *read* 1317
p. 39, St. **117**, **N 100 H**, Depth *for* 90(–0) *read* 99(–0)
p. 41, St. **124**, Depth 20 m., *σt*, *for* 27·04 *read* 27·06
p. 41, St. **125**, Depth 100 m., *σt*, *for* 27·32 *read* 27·34
p. 43, St. **129**, Depth 400 m., *σt*, *for* 27·70 *read* 27·63
Depth 600 m., *σt*, *for* 27·78 *read* 27·71
p. 45, St. **135**, Depth 140 m., Temp., *for* 0·22 *read* – 0·22
p. 45, St. **136**, Depth 210 m., *σt*, *for* 27·65 *read* 27·59
p. 49, St. **149**, **OTL**, etc., Time, Hauled, *for* 1158 *read* 1128
St. **150**, Gear, *for* **N 70 H** *read* **N 100 H**
p. 51, St. **160**, Depth 50 m., *σt*, *for* 26·95 *read* 26·97
p. 57, St. **190**, **N 70 V**, Depth, *for* 100–0 *read* 100–50
p. 59, St. **194**, Depth 300 m., *σt*, *for* 27·77 *read* 27·73
p. 62, St. **200**, Hour, *for* 1455 *read* 1445
p. 81, *for* St. **256 TYF** 250(–0) *read* St. **257 TYF** 250(–0)
p. 83, St. **265**, *for* **N 50 V** 50–0, etc., *read* **N 70 V** 50–0, etc.
p. 85, St. **265**, *for* **N 70 H** 500–250, etc., *read* **N 70 V** 500–250, etc.
St. **269**, Gear, *for* **TYF** *read* **N 450**
p. 93, St. **W S 8**, Gear **N 70 H**, Depth, *for* 87 *read* 50
for 174 *read* 100
p. 95, St. **W S 16**, **N 100 H**, Depth 90 cm., Time, Hauled, *for* 2122 *read* 2222
St. **W S 20**, **N 70 V**, Time, Hauled, *for* 0915 *read* 1015
p. 99, St. **W S 29**, **N 50 V**, Time, Shot, *for* 1315 *read* 1350
St. **W S 30**, Depth 100 m., S °/₀₀, *for* 34·95 *read* 33·95
p. 101, St. **W S 35**, Depth, *for* 105 *read* 145
p. 107, St. **W S 46**, **N 100 H**, Depth, *for* 143 *read* 146
p. 108, St. **W S 61**, Position, *for* 53° 37′ 30″ S *read* 52° 37′ 30″ S
p. 109, St. **W S 54**, Depth, *for* 600 *read* 500
St. **W S 58**, **N 100 H**, Depth, *for* 100 *read* 56
for 200 *read* 112
p. 110, St. **W S 61**, Position, *for* 53° 37′ 30″ S *read* 52° 37′ 30″ S
p. 117, St. **W S 95**, **DC**, Time, Hauled, *for* 0522 *read* 0532
p. 119, St. **W S 103**, **N 70 V**, Time, Hauled, *for* 2315 *read* 2305
Pl. I, Longitude, on upper edge of Plate, *for* 15° E *read* 10° E
for 20° E *read* 15° E

Doubtful values:

p. 61, St. **198**, Depth 1500 m., S °/₀₀ value 34·87 too high
σt value 28·09 too high
p. 63, St. **199**, Depth 700 m., S °/₀₀ value 35·01 too high
σt value 28·18 too high
p. 111, St. **W S 61**, Depth 2000 m., S °/₀₀ value 34·47 too low
σt value 27·66 too low

ADDENDUM

p. 51, St. **164**, **BTS**, **NCS–T**, 24–36 m. *A second haul made in same depth*, 1200–1215

[*Discovery Reports. Vol. I, pp. 1–140, Plates I–VI, January*, 1929]

DISCOVERY INVESTIGATIONS STATION LIST

1925–1927

CONTENTS

INTRODUCTION . . . . . *page* 3
R.R.S. 'DISCOVERY', STATIONS 1–299 6
R.S.S. 'WILLIAM SCORESBY', STATIONS WS 1–136 92
MARINE BIOLOGICAL STATION, SOUTH GEORGIA, STATIONS MS 1–82 132
SUMMARISED LIST OF STATIONS 139
PLATES I–VI . . . . . *following page* 140

PRINTED IN GREAT BRITAIN, AT THE UNIVERSITY PRESS, CAMBRIDGE

DISCOVERY INVESTIGATIONS
STATION LIST

1925–1927

(Plates I—VI)

INTRODUCTION

THE following lists contain particulars of all stations made by the R.R.S. 'Discovery', the R.S.S. 'William Scoresby' and by the staff of the Marine Biological Station at South Georgia up to the end of September 1927.

Stations made by the 'Discovery' are entered first and have no letters prefixed to the numbers. Those of the 'William Scoresby' follow (pp. 92–131) and are distinguished as WS 1, WS 2, etc. Finally (pp. 132–137) those of the Marine Biological Station are given, numbered MS 1, MS 2, etc.

Positions are given either in latitude and longitude or as true bearings of some fixed point on land.

The abbreviations used in denoting the nature of the bottom are:

blk.	black	g.	gravel	rad.	radiolarian
br.	brown	gl.	globigerina	rd.	red
c.	coarse	gn.	green	s.	sand
cl.	clay	gy.	grey	sft.	soft
crl.	coralline	h.	hard	sh.	shells
d.	dark	m.	mud	spk.	specks
di.	diatom	oz.	ooze	st.	stones
f.	fine	r.	rock	w.	white

÷ placed above the figure for the sounding indicates that bottom was not reached.

The directions of wind, sea and swell are true bearings and with the two first the force is expressed in terms of Beaufort's scale. Weather is indicated by Beaufort's symbols. Barometer readings are corrected for latitude and temperature. The air temperature was read in degrees Fahrenheit and is here converted to Centigrade. The age of the moon is expressed in days: the phases new moon, first quarter, full moon and last quarter are thus represented respectively by the numbers 1, 8, 15 and 22.

In the chemical observations all temperatures are fully corrected. Salinity (S $^{o}/_{oo}$) was determined by the chemical estimation of the chlorine content. Density (σt) is calculated from the corrected readings for temperature and salinity. Estimation of the hydrogen-ion concentration (pH) was made by the colorimetric method, phenol red and thymol blue being used as indicators. Phosphate content was determined by Atkins' method.

The following symbols are used for nets, apparatus, etc.:

B	Oblique.
BTS	Small beam trawl. Beam 8 ft. in length (2·45 m.): mesh at cod-end $\frac{1}{2}$ in. (12·5 mm.)*.
DC	Conical dredge. Mouth 16 in. in diameter (40·5 cm.), with canvas bag.

* All measurements are taken from knot to knot along one side of the mesh, not diagonally with the mesh stretched.

DGA	Depth gauge, Admiralty pattern.
DGB	Depth gauge, Budenberg pattern.
DGT	Depth gauge, reversing thermometer type.
DL	Large dredge. Light pattern, 4 ft. in length (1·2 m.).
DLH	Large dredge. Heavy pattern, 4 ft. in length (1·2 m.).
H	Horizontal.
HH	Hand harpoon.
KT	Kelvin tube.
LH	Hand lines.
N 4–T N 7–T	Nets with mesh of 4 mm. or 7 mm. (0·16 in. or 0·28 in.) attached to back of trawl.
N 50	50 cm. tow-net. Mouth circular, 50 cm. in diameter (19·5 in.): 200 meshes to the linear inch.
N 70*	70 cm. tow-net. Mouth circular, 70 cm. in diameter (27·5 in.): mesh graded, at cod-end 74 to the linear inch.
N 100	1 m. tow-net. Mouth circular, 1 m. in diameter (3·3 ft.): mesh graded, at cod-end 16 to the linear inch. From July 1, 1927, this net was replaced by another, of similar pattern, but with the cod-end made of stramin with 11–12 meshes to the linear inch.
N 200	2 m. tow-net. Mouth circular, 2 m. in diameter (6·6 ft.): mesh graded, at cod-end 4 mm. (0·16 in.).
N 450	4½ m. tow-net. Mouth circular, 4½ m. in diameter (14·8 ft.): mesh graded, at cod-end 7 mm. (0·28 in.).
NC 50	Coarse 50 cm. tow-net. Mouth circular, 50 cm. in diameter (19·5 in.): 25 meshes to the linear inch.
NCS–D NCS–N NCS–T	Tow-net of coarse silk, with 16 meshes to the linear inch, attached to dredge, trawl, or other net.
NH	Hand net.
NHS	High-speed tow-net. Mouth 3 in. in diameter (7·5 cm.): mesh 74 to the linear inch.
NRL	Large rectangular net. Frame 8 ft. long and 2¼ ft. wide (2·45 m. × 0·7 m.) with bag of ½ in. mesh (12·5 mm.).
NRM	Medium rectangular net. Frame 4 ft. long and 1¼ ft. wide (1·22 m. × 0·38 m.), with bag of 7 mm. mesh (0·28 in.).
NRS	Small rectangular net. Frame 3 ft. long and 1 ft. wide (0·9 m. × 0·3 m.), with bag of 4 mm. mesh (0·16 in.).
NS	Seine net. Length 30 fathoms (55 m.): mesh at cod-end 1½ in. (3·8 cm.).
OTC	Commercial otter trawl. Head rope 80 ft. long (24·5 m.): mesh at cod-end 1½ in. (3·8 cm.).
OTL	Large otter trawl. Head rope 40 ft. long (12·2 m.): mesh at cod-end 1¼ in. (3·2 cm.).
OTM	Medium otter trawl. Head rope 30 ft. long (9·14 m.): mesh at cod-end 1¼ in. (3·2 cm.).
RM	Mussel rake.
SL	Sondeur Léger.
STB	Baillie Sounding Rod.
STN	Sounding rod, Nansen-Ekman type.
TD	Transparency (or Secchi) disc, 50 cm. in diameter (19·5 in.).
TGL	Large gauze fish-trap. Cylindrical, 3 ft. long and 1 ft. in diameter (0·9 m. × 0·3 m.): gauze with 8 meshes to linear inch.
TGM	Medium gauze fish-trap. Cylindrical, 1½ feet long and 6 in. in diameter (45 cm. × 15 cm.): gauze with 16 meshes to linear inch.
TGS	Small gauze fish-trap. Cylindrical, 9 in. long and 3 in. in diameter (23 cm. × 7·5 cm.): gauze with 34 meshes to linear inch.

* In some early labels this net is incorrectly referred to as "N 75."

TNL Large fish-trap. Rectangular, 4 ft. by 4 ft. by 2½ ft. (1·2 m. × 1·2 m. × 0·75 m.), with netting or wire of ½ in. mesh (12·5 mm.).

TYF Young-fish trawl. Mouth about 20 ft. in circumference (6 m.): bag of stramin with 11 to 12 meshes to linear inch. Fished until July 1926, with poles and otter-boards, thereafter attached to a circular tow-net frame 2 m. in diameter (6·6 ft.).

V Vertical.

Unless specially noted to the contrary (by the addition of V) nets N 200 and N 450 were towed horizontally. To the symbols for smaller tow-nets (N 100, N 70, N 50, NC 50) B, H or V is always added to indicate the direction in which the haul was taken.

Vertical nets were hauled at 1 m. per second and, unless the haul ended at the surface, were closed by the Nansen method.

Oblique nets were hauled as soon as shot at a speed of 10 m. per minute, with the ship moving at about 2 knots.

Horizontal nets were shot open, but except for surface work were very frequently closed on the Nansen principle before being hauled. When no addition is made to the figures in the depth column, it is always to be understood that the tow-net or young-fish trawl was closed before hauling; but when such an expression as (– 0) or (– 50) follows the figure for depth, it is implied that the net, though fishing for the time indicated at the major depth, was hauled open to the surface or to a higher level. Plankton nets catch practically nothing while being shot: if closed before hauling there is good reason to believe that all the organisms were caught at the indicated depth. When, however, the net is hauled open to a higher level there is less certainty of this; for though it may have been towed for a considerable time at the greater depth, some organisms will have been caught during its upward passage.

When, at a single station, a number of similar hauls was made with the same type of net, the hauls are distinguished by letters which are entered in the "Remarks" column.

For determining the levels at which horizontal nets were towed and from which oblique nets were hauled, Kelvin tubes or depth gauges were constantly employed. A symbol indicating the type of gauge will be found in the "Remarks" column, and if no such symbol occurs it is to be understood that the depth was estimated.

Times are expressed on the 24-hour system, the day ending with midnight (0000). The entry under "shot" states the time when all the warp was paid out. That under "hauled" either gives the time when hauling began, or, with closing nets, the time when the messenger was estimated to have arrived. When series of vertical nets were taken, only the times for the beginning and end of the series are given. The times given are "ship's time," corresponding nearly with local mean time. In order to distinguish hauls which were made when it was dark, those times which fall between sunset and sunrise are printed in heavy type.

Length of tow was measured by the ship's log, by time and estimated speed, or by differences in observed positions.

At the end of the lists (p. 138) will be found a summary of the stations made by the 'Discovery' and 'William Scoresby' with references to the charts on which the positions are marked. A chart of South Georgia is added, on which the names of all places mentioned in the list of MS stations will be found.

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1925										
1	Clarence Bay, Ascension I, 7° 55′ 15″ S, 14° 25′ 00″ W	16 xi	1600	20 crl. s. sh.	SE	4	SE	3	b. c.	1013·3	23·9	mod. S swell
2	Clarence Bay, Ascension I, Catherine's Pt and Collyer Pt	17 xi	1200	—	S	3	SE	3	b. c.	1014·0	25·0	mod. S swell
3	29° 31′ 06″ S, 13° 56′ 45″ W	3 xii	1000	-	ENE	3	ENE	3	b. c.	1023·8	20·0	mod. E swell
		1926										
4	Tristan da Cunha, 36° 55′ 00″ S, 12° 12′ 00″ W	30 i	1200	37 st.	NNW	4	NNW	4	b. c.	1019·4	15·6	mod. S swell
			1600	—	W	5	conf.	4	b. c.	1019·0	16·7	mod. conf. swell
		31 i	1200	—	SW	6–7	WSW	6	b. c. g.	1014·8	16·1	heavy conf. swell
5	Tristan da Cunha, Quest Bay	31 i	1500	7–12 g. r.	W	6–7	—	0	b. c.	1016·0	16·7	heavy NW swell
6	Tristan da Cunha, 3 miles N 30° E of Settlement	1 ii	1300	80–140 r.	WSW	2	WSW	4	b. c.	1017·5	16·7	
7	39° 24′ 30″ S, 12° 08′ 00″ W	3 ii	1100	3200 gl. oz.								
			1200	—	WSW	3	WSW	2	o.	1016·7	12·2	v. heavy SW swell
			1600	—	WSW	3	WSW	3	o.	1016·1	11·1	,,
8	42° 36′ 30″ S, 18° 19′ 30″ W	8 ii	1030	3375 gl. oz.								
			1200	-	WNW	4	WNW	4	o. m.	1001·1	11·7	v. heavy conf. swell
			1600	—	NW	4	NW	4	o.	998·2	11·1	,,
			2000	—	NW	4	NW	4	b. c.	1000·5	10·6	,,
9	46° 11′ 30″ S, 22° 27′ 30″ W	11 ii	0730	4090 gl. oz.								
			0800	—	NW	3	NW	3	o. m. p.	1009·3	4·4	mod. NW swell
			1200	—	NW	3	NW	2	b. c	1009·3	7·8	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	*σt*	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
1	26	18	23·62	36·08	24·62	8·34	—	—	**NRM**	16–27	1630			
2	27	—	—	—	—	—	—	—	**Sh. coll.**	0	1130	1330		
3	15	—	—	—	—	—	—	—	**N 200**	500–700	1000	1100	2	DGB
4	17	0	14·59	34·85	25·96	—	—	—	**DL**	40–46	1400	1423		
		35	13·64	34·99	26·26	8·10	—	—	**N 70 H**	0–10	1600	1620		
	18	—	—	—	—	—	—	—	**N 100 H**	0–10	1750	1855	—	A
		—	—	—	—	—	—	—	,,	0–10	**2215**	0900	—	B 30–31 i 1926
		—	—	—	—	—	—	—	**LH**	40	1430	1000	—	30 i–1 ii 1926
5	18	—	—	—	—	—	—	—	**NRM**	7–12	1500	1630	—	several short hauls inside *Macrocystis* belt
6	19	—	—	—	—	—	—	—	**DL**	80–140	1315	1330	—	dredge hitched
7	21	0	12·71	34·79	26·01	8·24								
		5	12·66	34·79	26·32	—	41							
		10	12·64	34·79	26·32									
		20	12·61	34·79	26·33									
		30	12·60	34·81	26·35									
		40	12·54	34·80	26·35									
		50	12·46	34·79	26·36	8·24								
		75	11·96	34·81	26·47									
		100	10·85	34·83	26·59	8·22	95							
		150	10·20	34·83	26·70									
		200	9·85	34·79	26·85									
		300	8·97	34·60	26·84									
		400	6·97	34·43	27·28									
		500	5·52	34·33	27·19	8·14								
		1000	3·11	34·22	27·35									
		1500	2·66	34·51	27·30									
		2000	2·65	34·74	27·74	8·14	125							
		3000	2·41	34·80	27·81	8·14	90							
8	25	0	9·10	34·23	26·51	8·29	—	5·86	**N 200**	600–700	1410	1550	3	DGB
		5	9·10	34·25	26·53	—	—	—	**N 100 H**	0–10	1520	1540	$\frac{1}{2}$	
		10	9·08	34·25	26·54	—	—	—	,,	0	1615	1625	$\frac{1}{4}$	
		20	9·03	34·27	26·57	8·34	—	6·10	**N 200**	1500–1700	1910	**2123**	$3\frac{3}{4}$	DGB
		30	9·00	34·23	26·54									
		40	8·88	34·27	26·59									
		50	8·86	34·23	26·56									
		75	8·73	34·22	26·56									
		100	8·58	34·22	26·62									
		150	7·13	34·23	26·82									
		200	6·74	34·23	26·87									
		300	5·17	34·23	27·07									
		400	4·21	34·18	27·14									
		500	3·54	34·12	27·16									
		1000	2·68	34·22	27·31									
		2000	2·77?	34·72	27·71?	8·24	—	4·08						
		3000	1·97	34·77	27·81	8·16	—	4·00						
9	28	0	7·23	34·00	26·62	8·30	—	—	**N 70 V**	50–0	0730			
		5	7·23	34·00	26·62	—	105	—	,,	100–50				
		10	7·23	34·00	26·62	—	—	—	,,	250–100	—	0800		
		20	7·23	34·00	26·62	8·26	—	—	**N 200**	1250(–0)	1137	1445	$4\frac{1}{2}$	DGB
		30	7·19	34·00	26·63	—	—	—	**N 450**	3500(–0)	1137	1530	$4\frac{1}{2}$	net partially lost
		40	7·18	34·02	26·65	—	—	—	**N 100 H**	0–5	1206	1221	$\frac{1}{2}$	
		50	6·88	34·02	26·69									
		75	5·13	34·03	26·91									
		100	4·78	34·09	26·99	8·24	112							
		150	4·53	34·14	27·07									

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
9 *cont.*	46° 11′ 30″ S, 22° 27′ 30″ W	1926 11 ii										
10	46° 35′ 00″ S, 24° 15′ 30″ W	13 ii	1400	4402 rad. oz.								
			1600	—	SW	4	SW	5	o.	1025·1	6·1	
11	50° 26′ 00″ S, 30° 27′ 00″ W	16 ii	1000	5000 rad. oz.								
			1200	—	WNW	4	WNW	4	o.	1005·6	6·1	
12	51° 55′ 00″ S, 32° 27′ 30″ W	18 ii	1300	2744 di. oz.								
			1600	—	—	0–1	—	0	b.	1014·0	5·2	v. heavy W swell
			2000	—	—	1	—	0	b.	1016·1	—	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
9 *cont.*		200	3·80	34·14	27·15									
		300	3·29	34·13	27·18									
		400	2·93	34·14	27·24									
		500	2·74	34·20	27·28									
		1000	2·58	34·29	27·37									
		1500	2·50	34·70	27·72									
		2000	2·33	34·74	27·76	8·16	149							
		3000	1·34	34·74	27·84	8·09	179							
		4000	0·42	34·70	27·89	8·06								
10	2	0	7·43	34·05	26·63	8·34	—	6·27	**N 70 V**	50–0	1430			
		5	7·46	34·05	26·63	—	—	—	,,	100–50				
		10	7·46	34·05	26·63	—	—	—	,,	250–100				
		20	7·43	34·06	26·64	8·29	—	6·28	,,	500–250	—	1550		
		30	7·41	34·05	26·63									
		40	7·38	34·05	26·64									
		50	7·37	34·05	26·64									
		75	6·54	34·18	26·85									
		100	5·96	34·29	27·01	8·23								
		150	4·94	34·23	27·10									
		200	4·38	34·16	27·10									
		300	3·49	34·16	27·19									
		400	2·81	34·14	27·25									
		500	2·64	34·18	27·29									
		1000	2·54	34·47	27·53									
		1500	2·41	34·68	27·70									
		2000	2·33	34·79	27·80	8·16	—	4·15						
		3000	1·40	34·79	27·87	8·08	—	4·32						
11	5	0	5·36	33·95	26·83	8·26	—	—	**N 70 V**	50–0	1000			
		5	5·36	33·95	26·83	8·22	89	—	,,	100–50				
		10	5·36	33·96	26·84	8·22	—	—	,,	250–100				
		20	5·36	33·96	26·84	8·24	—	—	,,	500–250	—	1300		
		30	5·35	33·95	26·83	8·24								
		40	5·38	33·93	26·80	8·22								
		50	5·33	33·94	26·82	8·26								
		75	2·38	33·96	27·13	8·26								
		100	0·89	33·93	27·21	8·16	151							
		150	0·36	34·00	27·30	8·16								
		200	1·08	34·14	27·37	8·08								
		300	1·60	34·31	27·47	7·98								
		400	1·94	34·43	27·54	7·96								
		500	2·02	34·54	27·63	7·96								
		1000	1·95	34·42	27·52	7·96								
		1500	1·94	34·70	27·76	8·00								
		2000	—	34·81	—	8·00	138							
		3000	0·97	34·71	27·83	8·01	196							
		4500	0·15	34·65	27·83	8·01	209							
12	7	0	3·82	33·86	26·91	8·29	—	6·95	**N 70 V**	50–0	1415			
		5	3·71	33·86	26·92	—	—	6·81	,,	100–50				
		10	3·32	33·86	26·96	—	—	6·91	,,	250–100				
		20	3·10	33·86	26·98	8·29	—	6·94	,,	500–250	—	1615	—	net slightly torn
		30	3·10	33·86	26·98	—	—	6·85	**N 450**	1200–1500	**1930**	**2100**	1·5	
		40	3·05	33·87	27·00			6·92						
		50	2·61	33·89	27·05			7·02						
		75	0·51	33·91	27·22		—	7·12						
		100	0·25	33·94	27·25	8·16	—	6·93						
		150	0·02	34·11	27·41			6·08						
		200	0·39	34·04	27·33			5·48						
		300	1·64	34·07	27·27			4·33						
		400	1·82	34·52	27·64			4·04						

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
12 *cont.*	51° 55′ 00″ S, 32° 27′ 30″ W	1926 18 ii										
13	5·7 miles N 49½° E of Jason Lt, S Georgia	3 iii	0930 1200	143 gy. m. —	SE	3	SE	3	b. c.	994·7	2·2	
14	15·4 miles N 44½° E of Jason Lt, S Georgia	3 iii	1250	260 gy. m.	SE	2	S	2	o.	995·0	2·2	mod. NW swell
15	25 miles N 45½° E of Jason Lt, S Georgia	3 iii	1605	191 gy. m.	SW	2	SE	3	b. c.	995·8	2·2	
16	36·5 miles N 46° E of Jason Lt, S Georgia	3 iii	1905 2000	727 di. oz. —	SW	2	—	0	o. g.	998·2	1·7	mod. NW swell
17	46 miles N 46° E of Jason Lt, S Georgia	4 iii	0000	1950 di. oz. st.	SE	3		0–1	o. g.	997·7	2·2	v. heavy NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
12 *cont.*		500	1·85	34·61	27·70	—	—	3·94						
		600	1·87	34·61	27·76	—	—	3·97						
		1100	1·58	34·70	27·79	—	—	4·07						
		1600	1·08	34·70	27·82	—	—	4·33						
		2000	0·63	34·70	27·85	8·04	—	4·46						
		2600	0·47	34·70	27·86	—	—	4·54						
13	18	0	3·00	33·39	26·62	8·22	—	—	**N 70 V**	50–0	0930			
		5	3·00	33·39	26·62	—	—	—	,,	100–50				
		10	3·00	33·39	26·62	—	—	—	,,	135–100	—	0950		
		20	2·82	33·40	26·65	—	—	—	**N 200 V**	130–0	0955	1005		
		30	2·80	33·48	26·72									
		40	2·80	33·51	26·75									
		50	2·77	33·57	26·79									
		75	2·67	33·62	26·85									
		100	2·25	33·64	26·89									
		135	2·22	33·66	26·90									
14	18	0	3·01	33·84	26·98	—	—	—	**N 70 V**	50–0	1250			
		5	3·01	33·80	26·95	—	—	—	,,	100–50				
		10	3·00	33·80	26·95	—	—	—	,,	250–100				
		20	3·00	33·80	26·95	—	—	—	**N 200 V**	100–0				
		30	2·96	33·80	26·96	—	—	—	,,	250–100	—	1315		
		40	2·96	33·80	26·96									
		50	2·90	33·78	26·95									
		75	1·04	33·77	27·07									
		100	0·67	33·84	27·15									
		150	0·72	33·95	27·24									
		200	1·12	34·09	27·32									
		250	1·62	34·22	27·40									
15	18	0	2·77	33·80	26·97	—	108	—	**N 70 V**	50–0	1605			
		5	2·77	33·71	26·90	—	95	—	,,	100–50				
		10	2·77	33·71	26·90	—	76	—	,,	190–100				
		20	2·72	33·69	26·88	—	111	—	**N 200 V**	50–0				
		30	2·67	33·73	26·92	—	110	—	,,	100–50				
		40	2·54	33·64	26·86	—	113	—	,,	185–100	—	1630		
		50	1·62	33·64	26·93	—	120							
		75	0·84	33·71	27·04	—	131							
		100	0·72	33·75	27·08	—	128							
		140	0·64	33·78	27·11	—	135							
		175	1·13	33·84	27·12	—	160							
16	18	0	2·72	33·80	26·97	—	—	—	**N 70 V**	50–0	**1905**			
		5	2·72	33·80	26·97	—	—	—	,,	100–50				
		10	2·72	33·75	26·93	—	—	—	,,	250–100				
		20	2·72	33·75	26·93	—	—	—	,,	500–250				
		30	2·67	33·80	26·98	—	—	—	,,	700–500	—	**2045**		
		40	2·64	33·82	27·00	—	—	—	**N 200 V**	50–0	**1915**			
		50	2·63	33·84	27·01	—	—	—	,,	100–50				
		75	0·74	33·85	27·15	—	—	—	,,	500–100	—	**2000**		
		100	0·42	33·93	27·23									
		150	0·64	33·96	27·25									
		200	1·41	34·14	27·35									
		300	1·88	34·25	27·40									
		400	2·04	34·34	27·47									
		500	0·50	34·36	27·58									
		700	2·03	34·51	27·60									
17	19	0	2·62	33·78	26·97	—	—	—	**N 70 V**	50–0	**0000**			
		5	2·62	33·78	26·97	—	—	—	,,	100–50				
		10	2·62	33·77	26·95	—	—	—	,,	250–100				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
17 *cont.*	46 miles N 46° E of Jason Lt, S Georgia	1926 4 iii										
18	4·8 miles N 34° E of C Saunders, S Georgia	4 iii	1105 1200	140 r. —	SW	3	SW	3	b. c.	999·9	3·3	mod. NW swell
19	10 miles N 39° E of C Saunders, S Georgia	4 iii	1335	200 gn. m.								
20	14·6 miles N 41° E of C Saunders, S Georgia	4 iii	1530 1600	210 gn. m. —	SW	2	SW	2	b. c.	1001·4	4·4	mod. NW swell
21	20·5 miles N 44° E of C Saunders, S Georgia	4 iii	1750	326 m. r.								

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
17		20	2·62	33·75	26·94	—	—	—	**N 70 V**	500–250				
cont.		30	2·62	33·80	26·98	—	—	—	,,	750–500	—	**0235**		
		40	2·57	33·80	26·98	—	—	—	**N 200 V**	50–0	**0000**			
		50	2·42	33·80	27·00	—	—	—	,,	100–50				
		75	1·53	33·82	27·08	—	—	—	,,	500–100		**0115**		
		100	− 0·18	33·95	27·29									
		150	0·77	34·14	27·39									
		200	1·44	34·29	27·46									
		300	1·94	34·45	27·55									
		400	2·09	34·58	27·66									
		500	2·07	34·59	27·66									
		1000	1·78	34·72	27·79									
		1500	1·28	34·73	27·83									
		1900	0·93?											
18	19	0	3·12	33·80	26·94	—	—	—	**N 70 V**	50–0	1105			
		5	3·07	33·80	26·94	—	—	—	,,	100–50				
		10	3·02	33·78	26·94	—	—	—	,,	135–100				
		20	2·92	33·78	26·95	—	—	—	**N 100 V**	135–0				
		30	2·87	33·84	26·99	—	—	—	**N 200 V**	50–0				
		40	2·75	33·84	27·00		—	—	,,	135–50	—	1155		
		50	2·57	33·87	27·04									
		75	2·22	33·89	27·08									
		100	2·02	33·89	27·10									
		130	1·81	33·87	27·10									
19	19	0	3·02	33·79	26·94	—	—	—	**N 70 V**	50–0	1340			
		5	3·02	33·75	26·91	—	—	—	,,	100–50				
		10	2·93	33·75	26·93	—	—	—	,,	190–100				
		20	2·84	33·75	26·93	—	—	—	**N 100 V**	190–0				
		30	2·73	33·75	26·94	—	—	—	**N 200 V**	50–0				
		40	2·69	33·77	26·95	—	—	—	,,	100–50				
		50	2·62	33·78	26·97	—	—	—	,,	190–100	—	1420		
		75	1·97	33·80	27·03									
		100	1·12	33·84	27·12									
		150	0·62	33·91	27·21									
		190	0·64	34·02	27·30									
20	19	0	3·22	33·82	26·95	—	—	—	**N 70 V**	50–0	1530			
		5	3·22	33·82	26·95	—	—	—	,,	100–50				
		10	3·17	33·80	26·93	—	—	—	,,	200–100				
		20	3·02	33·80	26·95	—	—	—	**N 100 V**	200–0				
		30	2·97	33·80	26·95	—	—	—	**N 200 V**	50–0				
		40	2·82	33·80	26·96	—	—	—	,,	100–50				
		50	2·60	33·80	26·98	—	—	—	,,	200–100	—	1650		
		75	1·11	33·86	27·13									
		100	0·62	33·91	27·21									
		150	0·64	33·99	27·27									
		199	1·32	34·18	27·39									
21	19	0	3·10	33·80	26·94	—	—	—	**N 70 V**	50–0	1750			
		5	3·06	33·80	26·94	—	—	—	,,	100–50				
		10	2·98	33·78	26·94	—	—	—	,,	250–100				
		20	2·92	33·78	26·95	—	—	—	**N 100 V**	300–0				
		30	2·84	33·78	26·97	—	—	—	**N 200 V**	50–0				
		40	2·69	33·80	26·98	—	—	—	,,	100–50				
		50	2·22	33·82	27·03	—	—	—	,,	250–100	—	**1900**		
		75	0·63	33·86	27·17									
		100	0·45	33·95	27·26									
		150	0·87	34·04	27·31									
		200	1·57	34·18	27·38									
		300	1·72	34·31	27·47									

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
22	12 miles N 22½° E of Jason Lt, S Georgia	4 iii	2000	—	W	5	SW	5	b. c.	1016·6	2·8	
23	5·3 miles N 44° E of Merton Rock, S Georgia	14 iii	1200	228 gn. m.	—	0–1	—	0	c.	982·0	5·0	v. heavy NW sw
24	10 miles N 72° E of Jason Lt, S Georgia	14 iii	1600	—	NW	5	NW	5	b. c.	984·9	5·0	v. heavy NW sw
25	18 miles N 60° E of Jason Lt, S Georgia	14 iii	2000	—	NW	5	NW	5	b. c.	987·7	5·5	v. heavy NW sw
26	26·5 miles N 54° E of Jason Lt, S Georgia	14 iii										
27	W Cumberland Bay, S Georgia; 3·3 miles S 44° E of Jason Lt	15 iii	1200 1230	— 110 m. r.	NW	4	NW	4	o. f. g.	987·3	2·2	v. heavy NW sw
28	W Cumberland Bay, S Georgia; 3·3 miles S 45° W of Jason Lt	16 iii	1050 1150 1200	65 m. 168 m. —	NNW	3	—	0	b. c.	977·0	9·4	
29	W Cumberland Bay, S Georgia; 5·9 miles S 51° W of Jason Lt	16 iii	1330	23 m. st.	NW	3	NW	2	b. c.	977·0	7·2	
30	W Cumberland Bay, S Georgia; 2·8 miles S 24° W of Jason Lt	16 iii	1450 1600	251 m. st. —	SW	7	SW	2	b. c. q.	984·2	8·3	
31	13·5 miles N 89° E of Jason Lt, S Georgia	17 iii	1750 2000	220 gn. m.	SE	6	SE	5	o. g.	963·3	3·9	heavy conf. swe

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
22	19	—	—	—	—	—	—	—	**N 200 H**	60(–0)	**2020**	**2150**	3	
									,,	0	**2030**	**2140**	2·3	
23	1	0	2·67	33·80	26·98	—	—	—	**N 70 V**	50–0	1215			
		5	2·72	33·82	26·99	—	—	—	,,	100–50				
		10	2·57	33·91	27·07	—	—	—	,,	190–100				
		20	2·52	33·91	27·08	—	—	—	**N 50 V**	100–0	—	1255		
		30	2·52	33·78	26·98	—	—	—	**N 100 H**	60(–0)	1305	1320		
		40	2·38	33·84	27·03	—	—	—	,,	0	1310	,,		
		50	2·32	33·89	27·07									
		75	2·22	33·93	27·11									
		100	1·53	33·96	27·19									
		150	1·14	34·00	27·25									
		193	0·94	34·04	27·29									
24	1	—	—	—	—	—	—	—	**N 100 H**	60(–0)	1600	1700		
									,,	0	,,	,,		
25	1	—	—	—	—	—	—	—	**N 100 H**	60(–0)	**1825**	**1935**		
									,,	0–5	,,	,,		
26	—	—	—	—	—	—	—	—	**N 100 H**	60(–0)	**2045**	**2125**		
									,,	0–5	,,	,,		
27	2	—	—	—	—	—	—	—	**DL**	110	1230	1255	—	bag torn
28	3	0	2·77	32·07	25·59	—	—	—	**DC**	168	1150	1205		
		5	2·56	32·84	26·23									
		10	2·85	33·60	26·81									
		15	3·00	33·62	26·81									
		20	2·84	33·66	26·85									
		30	2·84	33·74	26·92									
		40	2·74	33·74	26·93									
29	3	0	2·78	32·41	25·86	—	—	—	**DC**	23	1345	1350		
		5	2·65	33·12	26·44									
		10	2·78	33·66	26·86									
		15	2·83	33·75	27·93									
		20	2·83	33·73	27·91									
30	3	0	2·93	32·68	26·06	—	—	—	**N 70 V**	50–0	1500			
		5	2·87	32·77	26·15	—	—	—	,,	100–50				
		10	2·92	33·40	26·65	—	—	—	,,	230–100	—	1600		
		15	2·87	33·66	26·85	—	—	—	**DLH**	251	1600	1610	—	stop of bridle parted
		20	2·83	33·73	26·90	—	—	—	,,	251	1635	1645		
		30	2·82	33·78	26·95									
		40	2·82	33·77	26·93									
		50	2·72	33·77	26·94									
		75	2·57	33·78	26·97									
		100	2·39	33·82	27·02									
		150	1·67	33·84	27·08									
		200	0·92	34·00	27·26									
31	4	0	3·02	33·71	26·88	—	—	—	**N 50 V**	100–0	1755			
		5	3·02	33·73	26·89	—	—	—	**N 70 V**	50–0				
		10	3·02	33·75	26·91	—	—	—	,,	100–50				
		20	2·94	33·75	26·92	—	—	—	,,	220–100	—	**1845**		
		30	3·02	33·86	26·99	—	—	—	**N 100 H**	0–5	**1910**	**2045**	3	
		40	2·94	33·89	27·03	—	—	—	,,	50(–0)	,,	,,	3	
		50	2·50	33·88	27·06	—	—	—	,,	90(–0)	,,	,,	3	
		75	2·15	33·88	27·09									
		100	1·64	33·89	27·33									
		150	1·02	34·00	27·26									
		200	0·83	34·04	27·30									

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
32	22·8 miles N 70½° E of Jason Lt, S Georgia	17 iii	0000	—	SW	7	SW	7	o.	969·4	2·2	v. heavy conf. swe
33	33 miles N 37° E of Jason Lt, S Georgia	18 iii	0800	—	var.	2	—	0	o. q.	984·8	5·0	heavy conf. swell
34	43 miles N 39° E of Jason Lt, S Georgia	18 iii	1200	—	SW	5	SW	6	b. c. q.	989·1	5·5	heavy W swell
35	53 miles N 40° E of Jason Lt, S Georgia	18 iii	1500	—	SW	5	SW	4	o.	993·6	3·9	v. heavy W swell
36	38 miles N 39° E of Jason Lt, S Georgia	18 iii	2000	—	SW	5	SW	4	o. m.	991·7	2·2	v. heavy W swell
37	28 miles N 36° E of Jason Lt, S Georgia	18–19 iii	0000	—	SSW	5	SW	5	o. g.	992·0	1·7	v. heavy W swell
38	18·5 miles N 33° E of Jason Lt, S Georgia	19 iii	0400	—	WSW	4	WSW	3	b.	995·7	1·7	heavy W swell
39	E Cumberland Bay, S Georgia. From 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock	25 iii	1445	179 gy. m.								
			1600	235 gy. m.	S	3	—	0	o. s.	988·5	0·6	
40	7 miles N 39° E of Barff Pt, S Georgia	28 iii	1000	–	N	3	N	1–2	b. c.	1010·5	1·1	
41	16½ miles N 39° E of Barff Pt, S Georgia	28 iii	1112	272 gy. m.								
			1200	—	N	3	—	0	c.	1010·5	2·8	
41 A	16½ miles N 39° E of Barff Pt, S Georgia. (Ship anchored by stern with kedge)											
41 B	,, ,,	—	1600	—	NW	4	NW	3	b. c. m.	1005·2	2·2	slight N swell
41 C	,, ,,											

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	*σt*	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
32	4	—	—	—	—	—	—	—	**N 100 H**	0–5	**2300**	**2358**	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	DGA
33	5	—	—	—	—	—	—	—	**N 100 H**	0–5	0945	1040	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	
34	5	—	—	—	—	—	—	—	**N 100 H**	0–5	1225	1335	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	
35	5	—	—	—	—	—	—	—	**N 100 H**	0–5	1505	1620	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	
36	5	—	—	—	—	—	—	—	**N 100 H**	0–5	**2010**	**2150**	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	
37	6	—	—	—	—	—	—	—	**N 100 H**	0–5	**0005**	**0120**	3	
									,,	50(–0)?	,,	,,	3	net slipped to end of warp
									,,	90(–0)	,,	,,	3	
38	6	—	—	—	—	—	—	—	**N 100 H**	0–5	**0355**	**0505**	3	
									,,	50(–0)	,,	,,	3	
									,,	90(–0)	,,	,,	3	
39	12	0	2·85	32·97	26·18	—	—	—	**OTL**					
		175	1·02	34·02	27·28	—	—	—	**N 4–T**	179–235	1445	1545	3·2	
									N 7–T					
40	14	—	—	—	—	—	—	—	**N 100 H**	0–5	1000	1018	1	
									,,	50(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
41	14	—	—	—	—	—	—	—	**N 100 H**	0–5	1112	1135	1	
									,,	50(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
41 A	—	0	2·43	33·86	27·04	8·26	—	6·74	**N 70 V**	50–0	1300			
		5	2·42	33·86	27·04	8·26	—	5·84	,,	100–50				
		10	2·42	33·86	27·04	8·25	—	6·83	,,	150–100				
		20	2·41	33·84	27·03	8·25	—	6·37	,,	265–150	—	1345		
		30	2·40	33·84	27·03	8·25	—	4·46						
		40	2·31	33·84	27·04	8·25	—	5·40						
		50	2·27	33·86	27·05	8·25	—	6·83						
		75	2·22	33·87	27·07	8·25	—	6·43						
		100	1·22	33·93	27·18	8·17	—	4·19						
		150	0·80	34·07	27·33	8·12	—	5·82						
		200	1·42	34·23	27·42	7·97	—	4·87						
		250	1·72	34·40	27·53	7·96	—	4·43						
41 B	—	—	—	—	—	—	—	—	**N 70 V**	50–0	1540			
									,,	100–50				
									,,	150–100				
									,,	265–150	—	1605		
									N 200 V	50–0	1500			
									,,	100–50				
									,,	150–100				
									,,	265–150	—	1545		
41 C	—	0	2·37	33·86	27·04	8·26	102	—	**N 50 V**	250–0	1715	1730		
		5	2·42	33·86	27·04	8·25	111	—	**N 70 V**	50–0	1700			
		10	2·42	33·84	27·03	8·25	128	—	,,	100–50				
		20	2·42	33·84	27·03	8·25	128	—	,,	150–100				
		30	2·40	33·85	27·04	8·25	131	—	,,	240–150	—	1728		
		40	2·39	33·84	27·03	8·25	123							
		50	2·31	33·86	27·05	8·25	123							
		75	2·22	33·87	27·07	8·25	128							

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
41 C *cont.*	16½ miles N 39° E of Barff Pt, S Georgia. (Ship anchored by stern with kedge)	1926 28 iii										
41 D	,, ,,	—	2000	—	NW	5	NW	4	o. r.	994·6	1·1	N swell rising
41 E	,, ,,	—	2100	—	NW	5–6	NW	4–5	o. r.	—	—	heavy N swell
42	Off mouth of Cumberland Bay, S Georgia. From 6·3 miles N 89° E of Jason Lt to 4 miles N 39° E of Jason Lt	1 iv	1200 1310	204 m. 120 m.	SE NE	5 5	SE NE	5 4	o. h.	986·0	3·3	mod. E swell
43	15 miles N 58° E of Jason Lt, S Georgia	3 iv	1330	—	WNW	5	WNW	4	o. m.	1004·5	3·3	mod. NW swell
44	32 miles N 51° E of Jason Lt, S Georgia	3 iv	2000	—	WNW	6	WNW	4	o. f.	1007·2	2·8	mod. NW swell
45	2·7 miles S 85° E of Jason Lt, S Georgia	6 iv	1155 1200 1306	270 gy. m. 238 gy. m.	— —	0–1 —	— —	0 0	b. c. b. c.	991·4 991·4	3·3 3·3	heavy NW swell heavy NW swell
46	51° 13′ 00″ S, 49° 50′ 00″ W	21 iv	2200	—	SW	7	SW	6	o.	1023·8	5·5	
47	50° 55′ 00″ S, 54° 38′ 00″ W	23 iv	2200	—	SW	3	SW	3	b. c.	1003·5	2·9	mod. SSE swell
48	8·3 miles N 53° E of William Pt Beacon, Port William, Falkland I	3 v	1200 1317	105 s. sh. 115 s. sh.	NE	4	NE	4	o. v.	994·1	6·7	
49	13·5 miles N 51° E of C Bougainville, E Falkland I	3 v	2100	—	—	0	—	0	b. c.	995·2	7·2	
50	2·3 miles S 80° E of Eddystone Rock, E Falkland I	4 v	1200	—	WNW	3	WNW	3	b. c.	1004·7	8·3	slight conf. swell
51	Off Eddystone Rock, E Falkland I. From 7 miles N 50° E to 7·6 miles N 63° E of Eddystone Rock	4 v	1315 1555 1600	115 f. s. 105 f. s. —	— — WNW	0–1 — 5	— — WNW	0 0 4	o. o. b. c.	992·4 992·4 1005·5	6·1 6·1 7·2	slight swell slight swell mod. conf. swell
52	Port William, E Falkland I, 7·4 cables N 17° E of Navy Pt	5 v	2000	17	NW	5	NW	5	o. r.	995·4	7·7	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
41 C *cont.*		100	1·12	33·93	27·19	8·17	197?							
		150	0·77	34·07	27·33	8·11	138							
		200	1·37	34·23	27·42	7·97	138							
		250	1·76	34·38	27·52	7·96	183?							
41 D	—	—	—	—	—	—	—	—	**N 70 V**	50–0	**1910**			
									,,	100–50				
									,,	150–100				
									,,	240–150	—	**1955**		
									N 200 V	50–0	**1900**			
									,,	100–50				
									,,	150–100				
									,,	240–150	—	**2030**		
41 E	—	0	2·42	33·78	26·99	8·20	—	5·82	**N 70 V**	50–0	**2105**			
		5	2·42	33·78	26·99	8·24	—	6·13	,,	100–50				
		10	2·42	33·83	26·99	8·25	—	4·82	,,	150–100				
		20	2·42	33·84	27·03	8·25	—	5·93	,,	250–150	—	**2140**		
		30	2·41	33·84	27·03	8·25	—	6·87						
		40	2·34	33·84	27·03	8·25	—	6·22						
		50	2·32	33·86	27·03	8·25	—	5·72						
		75	1·95	33·87	27·09	8·25	—	6·03						
		100	1·02	33·95	27·22	8·12	—	5·94						
		150	0·72	34·07	27·34	7·98	—	5·38						
		200	1·38	34·23	27·42	7·97	—	2·81						
		250	1·50	34·25	27·43	7·96	—	3·65						
42	18	100	2·08	33·86	27·06	—	—	—	**OTL**					
									N 7–T	120–204	1210	1310	4·6	
									N 4–T					
43	20	—	—	—	—	—	—	—	**N 100 H**	0–5	1338	1445	1	
									,,	75(–0)	,,	,,	1	
									,,	150(–0)	,,	,,	1	KT
44	20	—	—	—	—	—	—	—	**N 100 H**	0–5	**1855**	**2000**	1·3	
									,,	55(–0)	,,	,,	1·3	
									,,	110(–0)	,,	,,	1·3	
									,,	170(–0)	,,	,,	1·3	
45	23	0	2·55	33·82	27·01	—	—	—	**NH**	0	1135			
		260	1·37	34·22	27·40	—	—	—	**OTL**					
									N 7–T	238–270	1155	1306	4	
									N 4–T					
									NCS–T					
46	10	0	5·02	34·02	26·92	—	—	—	**N 100 H**	0–5	**2200**	**2215**		
47	12	0	5·88	34·05	26·83	—	—	—	**N 100 H**	0–5	**2200**	**2220**		
48	20	0	7·35	33·86	26·49	—	—	—	**OTL**					
		105	7·14	33·77	26·45	—	—	—	**N 7–T**	105–115	1214	1317	—	net very badly torn
									N 4–T					
									NCS–T					
49	20	0	7·5	33·77	26·40	—	—	—	**N 100 H**	0–5	**2100**	**2120**		
50	21	0	8·25	33·82	26·33	—	—	—	**N 100 H**	0–5	1050	1115		
									,,	50(–0)	,,	,,		
51	21	0	8·1	33·80	26·33	—	—	—	**DLH**	115	1320	1328		
		110	7·86	33·80	26·38	—	—	—	**OTL**					
									N 7–T	105–115	1517	1547		
									N 4–T					
									NCS–T					
52	22	—	—	—	—	—	—	—	**LH**	17	**2100**			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
53	Port Stanley, E Falkland I. Hulk of "Great Britain"	12 v	1600	—	SW	5	—	0	b. c.	1010·5	6·7	
54	Port Stanley, E Falkland I	15 v	1600	—	NE×N	2	—	0	b. c.	1006·1	6·7	
55	Entrance to Port Stanley, E Falkland I, 2 cables S 24° E of Navy Pt	16 v	1200 1415 1430	— 16 10	W	2	—	0	o. d.	1005·6	6·7	
56	Sparrow Cove, Port William, E Falkland I, 1½ cables N 50° E of Sparrow Pt	16 v	1530 1545	10½ 16								
57	Port William. E Falkland I, 5½ cables S 20° W of Sparrow Pt	16 v	1600 1615	15 15	—	0–1	—	0	b. c.	1009·2	6·1	
58	Port Stanley, E Falkland I	19 v	1600	—	NW	7	NW	3	o. d.	1009·0	7·8	
59	51° 22′ 00″ S, 57° 20′ 00″ W	20 v	1600	—	N	2	—	0	b. c. v.	1016·1	6·6	
60	50° 45′ 00″ S, 56° 33′ 00″ W	21 v	0400	—	SE	2	—	0	b. v.	1017·6	6·6	heavy N swell
61	50° 00′ 00″ S, 55° 36′ 00″ W	21 v	1200	—	SE	4	ESE	4	f.	1020·8	5·0	
62	49° 22′ 00″ S, 54° 48′ 00″ W	22 v	0000	—	E	3	—	0	o.d.m.	1022·2	5·6	heavy N swell
63	48° 50′ 00″ S, 53° 56′ 00″ W	22 v	1000	—	SE × E	4	SE × E	4	o. u.	1021·5	5·0	heavy N swell
64	48° 34′ 00″ S, 53° 34′ 30″ W	22 v	1600	4136 gl. oz.	NNW	2	NNW	2	o.d.m.	1020·0	8·3	mod. N swell
65	48° 18′ 00″ S, 53° 09′ 00″ W	22 v	2000	—	NNW	2	NNW	2	o.d.m.	1020·0	7·2	mod. N swell
66	48° 09′ 00″ S, 52° 50′ 00″ W	23 v	0400	—	—	0	—	0	o.	1018·7	8·9	mod. N swell
67	47° 18′ 00″ S, 51° 52′ 00″ W	23 v	1200	—	ESE	6	ESE	5	o.d.m.	1000·0	10·5	mod. N swell
68	46° 40′ 00″ S, 51° 22′ 00″ W	24 v	0000	—	SE	8	SE	7	o.u.d.	1009·0	10·5	conf. swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	*σt*	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
53	2	—	—	—	—	—	—	—	**RM**	0–2	1400	1500		
54	5	—	—	—	—		—	—	**Sh. coll.**	—	1500			
55	6	0	5·85	32·99	26·03	—	—	—	**BTS**	10–16	1415	1430		
		10	5·85	33·28	26·26	—	—	—	**NCS–T**					
56	6	0	6·10	33·37	26·27	—	—	—	**BTS**	10½–16	1530	1545		
		16	6·34	33·69	26·50	—	—	—	**NCS–T**					
57	6	0	5·95	33·21	26·17	—	—	—	**BTS**	15	1600	1615		
		15	6·29	—	—	—	—	—	**NCS–T**					
58	8	—	—	—	—	—	—	—	**N 70 H**	0–1	1510	1520		
									RM	1–2	1530	1535	—	piles of Govt Jetty
									N 70 H	0–5	1600	1610		
59	9	—	—	—	—	—	—	—	**N 100 H**	0–5	**1645**	**1725**	1	
									,,	40(–0)	,,	,,	1	
									,,	75(–0)	,,	,,	1	
60	10	—	—	—	—	—	—	—	**N 100 H**	0–5	**0317**	**0350**	1	
									,,	40(–0)	,,	,,	1	
									,,	75(–0)	,,	,,	1	
61	10	—	—	—	—	—	—	—	**N 100 H**	0–5	1220	1240	1	
									,,	55(–0)	,,	,,	1	
									,,	95(–0)	,,	,,	1	
62	11	—	—	—	—	—	—	—	**N 100 H**	0–5	**0130**	**0207**	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
									N 70 H	0–5	,,	,,	1	net torn away
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
63	11	—	—	—	—	—	—	—	**NH**	0	1000			
64	11	—	—	—	—	—	—	—	**N 100 H**	0–5	**1630**	**1705**	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
									N 70 H	0–5	,,	,,	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
65	11	—	—	—	—	—	—	—	**N 200 H**	120(–0)	**2111**	**2141**	1	
66	12	—	—	—	—	—	—	—	**N 100 H**	0–5	**0355**	**0430**	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
									N 70 H	0–5	,,	,,	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
67	12	—	—	—	—	—	—	—	**N 100 H**	0–5	1320	1345	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
									N 70 H	0–5	,,	,,	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
68	13	—	—	—	—	—	—	—	**N 100 H**	0–5	**0055**	**0120**	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	net badly torn
									N 70 H	0–5	,,	,,	1	
									,,	45(–0)	,,	,,	1	about half sample lost
									,,	90(–0)	,,	,,	1	net badly torn

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
69	45° 06′ 00″ S, 49° 00′ 00″ W	25 v	1600	—	E	6	E	6	b. c.	1027·7	8·9	conf. swell
70	44° 15′ 00″ S, 47° 58′ 00″ W	26 v	2000	—	ENE	7	ENE	7	o. u. q.	1020·6	10·5	heavy conf. swell
71	43° 20′ 00″ S, 46° 02′ 00″ W	30 v	0730	5460 di. oz. rd. cl.								
			0800	—	WSW	5	WSW	3	c. g.	1006·0	11·1	heavy NE swell
			1200	—	SW	6	SW	6	o. r. g.	1003·0	10·0	,,
			1600	—	SW	6–7	SW	6	b.	1006·9	8·3	mod. conf. swell
72	41° 43′ 20″ S, 42° 20′ 40″ W	1 vi	1100	5420								
			1200	—	NNE	4	NNE	4	o.	1002·2	13·6	mod. conf. swell
			1600	—	N × W	3	N × W	2	b. p. q.	997·5	13·3	,,
			2000	—	NW	4	N × W	2	b. l.	996·3	13·9	,,
73	41° 07′ 00″ S, 39° 33′ 00″ W	2 vi	2000	—	WSW	3	SW	4	b. c.	1012·8	11·1	mod. conf. swell
74	40° 30′ 40″ S, 38° 14′ 50″ W	3 vi	0800	—	W	3	W	3	b. c.	1018·5	12·6	heavy N swell
			0930	5446 di. oz. rd. cl.								
			1200	—	W × S	4	SW	4	b. c.	1018·5	11·7	v. heavy conf. swe
			1600	—	W	3	W	3	b. c.	1020·8	12·2	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
69	14	—	—	—	—	—	—	—	**N 100 H**	0–5	**1655**	**1725**	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
									N 70 H	0–5	,,	,,	1	
									,,	45(–0)	,,	,,	1	
									,,	90(–0)	,,	,,	1	
70	14	—	—	—	—	—	—	—	**N 100 H**	0–5	**2043**	**2120**	1	
71	18	0	10·16	34·34	26·43	8·30	—	—	**N 70 V**	50–0	0730			
		5	10·15	34·34	26·43	8·30	—	—	,,	100–50				
		10	10·15	34·35	26·44	8·30	—	—	,,	250–100				
		20	10·13	34·36	26·47	8·30	—	—	,,	500–250				
		30	10·13	34·35	26·45	8·30	—	—	,,	750–500				
		40	10·13	34·35	26·45	8·26	—	—	,,	1000–750	—	1110		
		50	10·18	34·35	26·44	8·26	—	—	**TYF**	2000(–0)	1430	1530		
		75	10·12	34·35	26·44	8·24								
		100	7·89	34·43	26·87	8·24								
		150	6·94	34·43	27·01	8·23								
		200	6·12	34·36	27·05	8·20								
		300	4·85	34·27	27·23	8·16								
		5400	0·15	34·63	27·79	8·15								
72	20	0	12·65	34·67	26·22	8·30	—	—	**N 70 V**	50–0	1120			
		5	12·63	34·67	26·22	8·30	—	—	,,	100–50				
		10	12·63	34·67	26·22	8·30	—	—	,,	250–100				
		20	12·62	34·67	26·23	8·30	—	—	,,	500–250				
		30	12·62	34·67	26·23	8·30	—	—	,,	750–500				
		40	12·61	34·69	26·24	8·30	—	—	,,	1000–750	—	1510		
		50	12·61	34·68	26·24	8·30	—		**N 450**	2000(–0)	**1715**	**1846**	4·5	net torn
		75	10·29	34·43	26·48	8·29								
		100	8·89	34·42	26·70	8·27								
		150	7·61	34·51	26·97	8·08								
		200	6·50	34·42	27·04	8·08								
		300	4·62	34·23	27·13	8·08								
		400	4·03	34·18	27·16	8·06								
		500	3·42	34·18	27·22	8·06								
		1000	2·64	34·33	27·40	7·98								
		1500	2·75	34·60	27·61	7·98								
		2000	2·78	34·78	27·76	7·97								
		3000	2·67	34·86	27·83	7·98								
		4000	1·39	34·76	27·84	7·98								
		5000	0·27	34·69	27·85	7·98								
73	21	—	—	—	—	—	—	—	**N 100 H**	0–5	**2020**	**2050**	1	
74	22	0	13·61	34·86	26·17	8·32	—	—	**N 70 V**	50–0	0930			
		5	13·61	34·86	26·17	8·32	—		,,	100–50				
		10	13·61	34·85	26·16	8·32	—	—	,,	250–100				
		20	13·63	34·85	26·16	8·32	—		,,	500–250				
		30	13·73	34·85	26·14	8·32	—		,,	750–500				
		40	13·94	34·99	26·21	8·32			,,	1000–0	—	1210		
		50	14·06	35·00	26·20	8·32			**N 100 H**	0–5	1455	1530	1	
		75	14·26	35·21	26·32	8·32		—	,,	45(–0)	,,	,,	1	
		100	14·52	35·46	26·45	8·30	—		,,	90(–0)	,,	,,	1	
		150	13·30	35·30	26·59	8·29								
		200	12·01	35·10	26·69	8·28								
		300	11·29	34·71	26·52	8·26								
		400	10·97	34·42	26·34	8·26								
		500	5·34	34·25	27·06	8·14								
		1000	3·05	34·23	27·30	8·12								
		2500	2·96	34·88	27·82	8·04								
		4000	2·00	34·81	27·85	8·04								
		5400	0·51	34·67	27·83	8·02								

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
75	40° 08′ 00″ S, 37° 15′ 00″ W	4 vi	1600	—	—	1	SW	1	o.	1027·8	11·1	mod. SSW swell
76	39° 50′ 30″ S, 36° 23′ 00″ W	5 vi	1200	—	W	2	—	0	b. c.	1027·5	12·9	slight SW swell
77	39° 19′ 30″ S, 35° 27′ 40″ W	6 vi	0800	—	—	0–1	—	0	b. c.	1024·8	11·7	slight SW swell
			0950	5186 di. oz. rd. cl.								
			1200	—	—	0–1	—	0	b. c.	1024·5	15·0	,,
78	35° 18′ 00″ S, 19° 01′ 10″ W	12 vi	0800	—	SW	3	SW	3	b. c.	1016·4	12·2	heavy SW swell
			0935	3410 gl. oz.								
			1200	—	WSW	2	WSW	2	b. c.	1016·0	13·9	heavy WSW swell
			1600	—	NNE	2	NNE	2	o. g.	1015·2	11·1	heavy conf. swell
79	34° 48′ 00″ S, 16° 36′ 00″ W	13 vi	1200	—	N × E	4	N × E	4	o. r.	1006·6	11·1	heavy SW swell
			1600	—	W × N	2	W × N	2	b. c.	1004·1	15·0	heavy conf. swell
80	32° 46′ 00″ S, 10° 00′ 00″ W	17 vi	0000	—	W × N	5	W × N	4	b. c.	1015·0	16·1	heavy W swell
81	32° 45′ 00″ S, 8° 47′ 00″ W	18 vi	1200	—	W	4	W	3	b. c.	1014·2	17·2	heavy conf. swell
82	32° 42′ 00″ S, 2° 05′ 00″ W	20 vi	2200	—	S	4	S	5	b. c.	1027·3	13·3	bright moonlight
83	32° 30′ 50″ S, 1° 23′ 30″ W	21 vi	0930	4308 gl. oz.								
			1200	—	—	0–1	—	0	c. v.	1027·1	15·6	heavy SW swell
			1600	—	WNW	5	WNW	4	o.	1026·9	15·0	heavy conf. swell
			2000	—	WNW	5	WNW	4	c.	1025·3	16·1	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
75	23	—	—	—	—	—	—	—	**N 70 H**	75(–0)	1340	1550	1	
76	24	—	—	—	—	—	—	—	**N 450**	1500(–0)	1152	1340	1·1	
77	25	0	13·99	34·92	26·13	8·34	—	—	**N 70 V**	50–0	0950			
		5	13·99	34·92	26·13	8·34	—	—	,,	100–50				
		10	13·99	34·92	26·13	8·34	—	—	,,	250–100				
		20	13·99	34·94	26·16	8·34	—	—	,,	500–250				
		30	13·99	34·96	26·17	8·34	—	—	,,	750–500				
		40	13·99	34·96	26·17	8·34	—	—	,,	1000–750	—	1230		
		50	13·36	34·87	26·24	8·34								
		75	12·51	34·78	26·34	8·32								
		100	11·11	34·85	26·65	8·32								
		150	8·75	34·60	26·87	8·29								
		200	7·22	34·42	26·85	8·29								
		300	5·12	34·29	27·12	8·06								
		400	4·79	34·23	27·11	8·04								
		500	—	34·18	—	8·04								
		1000	2·93	34·25	27·30	8·02								
		1500	2·66	34·43	27·49	8·02								
		2000	2·65	34·60	27·62	8·00								
		3500	2·56	34·85	27·82	8·00								
		5000	0·13	34·67	27·68	8·00								
78	3	0	14·19	35·00	26·17	8·34	—	—	**N 70 V**	50–0	0935			
		5	14·19	35·00	26·17	8·34	—	—	,,	100–50				
		10	14·19	35·00	26·17	8·34	—	—	,,	500–0				
		20	14·19	35·00	26·17	8·34	—	—	,,	1000–0	—	1215		
		30	14·19	35·00	26·17	8·34	—	—	**TYF**	1000(–0)	1300	1435	3	
		40	14·19	35·00	26·17	8·34	—	—	**NH**	0	1130			
		50	14·19	35·00	26·17	8·34	—	—	**N 100 H**	110(–0)	1355	1455	1	
		75	14·04	35·03	26·22	8·34								
		100	14·02	35·08	26·27	8·34								
		150	13·04	35·26	26·51	8·34								
		200	12·19	35·14	26·68	8·34								
		300	11·16	35·00	26·77	8·32								
		400	10·49	34·90	26·81	8·30								
		500	8·36	34·58	26·92	7·70								
		1000	3·11	34·23	27·29	8·07								
		1500	2·68	34·47	27·52	7·70								
		2000	2·74	34·66	27·66	8·05								
		3000	2·48	34·87	27·85	8·05								
79	4	—	—	—	—	—	—	—	**N 450**	1000–0	1420	1525	1·5	net largely torn away
80	7	—	—	—	—	—	—	—	**N 200**	30–0	**2250**	**2325**		
81	8	—	—	—	—	—	—	—	**N 450**	650(–0)	1005	1135	2·3	DGT
82	10	—	—	—	—	—	—	—	**N 200**	75(–0)	**2210**	**2310**	1·7	
83	11	0	16·31	35·43	26·03	8·34	—	—	**N 70 V**	50–0	0945			
		5	16·31	35·43	26·03	8·34	—	—	,,	100–50				
		10	16·31	35·43	26·03	8·34	—	—	,,	250–100				
		20	16·31	35·43	26·03	8·34	—	—	,,	500–250				
		30	16·31	35·44	26·04	8·34	—	—	,,	750–500				
		40	16·31	35·44	26·04	8·34	—	—	,,	1000–750				
		50	16·31	35·44	26·04	8·34	—	—	,,	2000–1500	—	1230		
		75	16·30	35·44	26·04	8·34	—	—	**N 200**	650(–0)	**2012**	**2112**		
		100	16·19	35·43	26·06	8·34								
		150	14·36	35·30	26·36	8·34								
		200	13·11	35·17	26·43	8·34								

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
83 *cont.*	32° 30′ 50″ S, 1° 23′ 30″ W	21 vi										
84	32° 52′ 00″ S, 1° 55′ 00″ E	22 vi	1900	2233								
			2000	gl. oz.	WNW	6	WNW	6	b. c.	1018·9	13·9	
85	33° 07′ 40″ S, 4° 30′ 20″ E	23 vi	1200	—	—	0–1	—	1	b. c.	1021·6	16·1	heavy NW swell
			1330	4943								
			1600	—	—	0–1	—	1	c.	1019·1	16·1	heavy W swell
			2000	—	WNW	2	—	1	c. m.	1020·6	15·6	,,
86	33° 25′ 00″ S, 6° 31′ 00″ E	24 vi	1200	—	NW	5	NW	4	b. c.	1021·6	17·2	mod. W swell
			1600	—	NW	5	NW	4	b. c. q.	1020·7	16·1	,,
87	33° 53′ 45″ S, 9° 26′ 30″ E	25 vi	1030	5081 gl. oz.								
			1200	—	NW	4	NW	4	b. c.	1020·1	16·6	heavy NW swell
			1600	—	NW	5	NW	4	b. c.	1019·2	16·1	mod. NW swell
88	34° 04′ 00″ S, 13° 00′ 00″ E	27 vi	0800	—	SSE	4	SSE	3	b. c.	1023·1	17·8	heavy SW swell
			1200	—	SSE	3	SSE	2	b. c.	1023·6	16·1	,,
89	34° 05′ 15″ S, 16° 00′ 45″ E	28 vi	1110	3926 gl. oz.								
			1200	—	—	0–1	—	0	c.	1024·5	16·1	heavy SW swell
			1600	—	—	0–1	—	0	b. c. v.	1024·5	16·1	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
83 *cont.*		300	12·07	34·97	26·58	8·34								
		400	11·49	34·97	26·69	8·32								
		500	11·06	34·94	26·78	8·29								
		1000	5·16	34·32	27·13	8·07								
		1500	3·13	34·36	27·39	8·02								
		2000	2·80	34·60	27·61	7·97								
84	12	2000	2·71	34·79	27·77	—	—	—	**DLH** / **NCS–D**	2000–0	**1930**	**1958**	—	dredge failed to reach bottom
85	13	0	16·26	35·48	26·07	8·35	25	—	**N 70 V**	50–0	1345			
		5	16·19	35·50	26·11	8·34	28	—	,,	100–50				
		10	16·12	35·50	26·12	8·34	28	—	,,	250–100				
		20	16·05	35·52	26·15	8·34	28	—	,,	500–250				
		30	16·02	35·52	26·16	8·34	28	—	,,	500–0				
		40	16·01	35·51	26·15	8·34	29	—	,,	750–500				
		50	15·98	35·52	26·17	8·34	30	—	,,	1000–750	—	1630		
		75	15·81	35·51	26·20	8·34	28	—	**N 450**	2000(–0)	**1805**	**2007**	2·0	
		100	15·01	35·50	26·38	8·34	28							
		150	14·24	35·50	26·52	8·34	28							
		200	13·11	35·19	26·54	8·32	38							
		300	11·66	35·02	26·68	8·30	48							
		400	9·95	34·83	26·85	8·20	56							
		500	8·59	34·68	26·95	8·20	63							
		1000	3·51	34·41	27·38	8·07	106							
		1500	2·76	34·67	27·65	8·07	114							
		2000	2·74	34·88	27·84	8·02	112							
		3000	2·36	34·97	27·92	8·02	112							
		4800	1·01	34·85	27·94	8·02	123							
86	14	—	—	—	—	—	—	—	**N 450**	1000(–0)	1155	1615	3·0	
87	15	0	16·51	35·55	26·07	8·35	—	—	**N 70 V**	50–0	1045			
		5	16·51	35·55	26·07	8·35	—	—	,,	100–0				
		10	16·51	35·55	26·07	8·35	—	—	,,	100–50				
		20	16·51	35·55	26·07	8·35	—	—	,,	250–135				
		30	16·51	35·55	26·07	8·35	—	—	,,	500–250				
		40	16·51	35·53	26·06	8·35	—	—	,,	1000–0	—	1315		
		50	16·51	35·55	26·07	8·35	—	—	**TYF**	1000(–0)	1540	1710	1·7	
		75	16·51	35·55	26·07	8·35								
		100	16·51	35·55	26·07	8·35								
		150	16·51	35·50	26·03	8·35								
		200	16·29	35·50	26·08	8·35								
		300	15·21	35·50	26·33	8·35								
		400	14·31	35·28	26·36	8·34								
		500	13·37	35·17	26·57	8·34								
		1000	7·57	34·56	27·00	8·29								
		1500	3·42	34·31	27·57	8·08								
		2000	2·82	34·56	27·57	7·98								
		2900	2·49	34·85	27·83	7·97								
		4800	1·06	34·76	27·87	7·97								
88	17	—	—	—	—	—	—	—	**N 100 H**	3000–0	1130	1315	3·5	
89	18	0	16·53	35·55	26·07	8·35	—	—	**N 70 V**	50–0	1115			
		5	16·51	35·53	26·06	8·35	—	—	,,	100–50				
		10	16·51	35·53	26·06	8·35	—	—	,,	250–100				
		20	16·51	35·53	26·06	8·35	—	—	,,	500–0				
		30	16·51	35·53	26·06	8·35	—	—	,,	500–250				
		40	16·51	35·53	26·06	8·35	—	—	,,	750–500	—	1330		
		50	16·51	35·53	26·06	8·35	—	—	**N 200 H**	180(–0)	1435	1535	2·2	KT
		75	16·41	35·52	26·07	8·35	—	—	**TYF**	1000(–0)	1420	1555	2·2	
		100	16·24	35·50	26·09	8·35								

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
89 *cont.*	34° 05′ 15″ S, 16° 00′ 45″ E	28 vi										
90	Simon's Town, False Bay, S Africa. Basin of H.M. Dockyard	10 vii	1200	—	var.	3	—	0	c. p.	1028·4	14·4	
			1600	—	—	0–1	—	0	c.	1027·0	12·2	
			0000	—	—	0–1	—	0	b. c.	1030·5	12·2	
		11 vii	0000	—	—	0–1	—	0	b. c.	1031·5	15·0	
		12 vii	0800	—	—	0–1	—	0	b. c.	1029·9	14·4	
91	0·5 mile off Roman Rock, False Bay, S Africa	8 ix	1200	35 s.	SE	3	SE	2	b. c.	—	14·9	
92	34° 30′ 00″ S, 18° 29′ 00″ E	22 ix	1600	—	WSW	3	WSW	2	b. c.	1020·5	13·9	mod. W swell
93	33° 08′ 00″ S, 17° 50′ 00″ E	23 ix	1200	—	SW	5	SW	4	b. c.	1024·3	13·3	heavy SW swell
			1310	165 gn. m.								
			1600	—	SW	4	SW	3	b. c.	1022·1	14·4	heavy W swell
94	33° 18′ 00″ S, 17° 40′ 00″ E	23 ix	1600	—	SW	4	SW	3	b. c.	1022·1	14·4	heavy W swell
			1745	281 gn. m.								
			2000	—	SSE	4	SSE	3	b. c.	1024·1	13·9	,,
95	33° 30′ 00″ S, 17° 29′ 00″ E	23–24 ix	2230	440 gn. m.								
			0000	—	SW	3	SW	3	b. c.	1026·1	13·3	heavy SW swell
96	33° 06′ 00″ S, 17° 01′ 00″ E	24 ix	0710	620 m. gl. oz.								
			0800	—	S	3	S	3	b.	1025·0	14·4	v. heavy SW sw

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
89		150	14·96	35·25	26·19	8·35								
mt.		200	14·83	35·37	26·33	8·32								
		300	12·21	35·01	26·60	8·32								
		400	10·60	34·90	26·79	8·32								
		500	8·53	34·54	26·86	8·29								
		1000	3·52	34·38	27·37	8·00								
		1500	2·72	34·61	27·63	7·98								
		2000	2·83	34·85	27·80	7·97								
		3000	2·40	34·83	27·83	7·96								
90	2–7	—	—	—	—	—	—	—	**NH**	0–2	1000	1400		
									NRM	10–12	1430	1530		
									TGL	10	**2100**	0900	—	10–11 vii
									LH	10	—	—	—	11 vii
									TGL	10	**1800**	0830	—	11–12 vii
									NH	1	0930	—	—	12 vii
									Sh. coll.	—	1400	—	—	15 vii. Dry dock
91	2	0	13·51	35·28	26·72	—	—	—	**TYF**	0–5	1100	1120		
		17	13·45	35·23	26·64	—	—	—	**NRL**	35	1140	1205		
		34	13·44	35·23	26·63	—	—	—	**NCS–N**					
92	16	—	—	—	—	—	—	—	**N 100 H**	0–5	1605	1655	1	
									,,	50	1600	1700	1	
93	17	0	14·06	35·39	26·50	—	26	—	**N 70 V**	50–0	1310	—	—	TD 14½ m. (sunlight)
		5	14·01	35·39	26·51	—	30	—	,,	100–50				
		10	13·99	35·37	26·49	—	88?	—	,,	155–100	—	1400		
		20	13·84	35·35	26·50	—	34	—	**N 100 H**	0–5	1440	1550	2½	
		30	13·81	35·35	26·51	—	38	—	,,	70	1435	1535	2½	
		40	13·76	35·36	26·53	—	38	—	,,	140	1444	1600	2½	KT
		50	13·51	35·35	26·57	—	45	—	**N 70 H**	0–5	1440	1550	2½	
		75	11·62	35·03	26·70	—	81	—	,,	70	1435	1535	2½	
		100	9·40	34·78	26·90	—	83	—	,,	140	1444	1600	2½	KT
		150	8·12	34·63	26·99	—	96							
94	17	0	14·43	35·41	26·43	—	—	—	**N 70 V**	50–0	1800			
		5	14·42	35·41	26·43	—	—	—	,,	100–50				
		10	14·42	35·41	26·43	—	—	—	,,	250–100	—	1825		
		20	14·41	35·42	26·43	—	—	—	**N 100 H**	0–5	**1855**	**2005**	1	
		30	14·39	35·42	26·44	—	—	—	,,	90	,,	,,	1	
		40	14·31	35·42	26·46	—	—	—	,,	180	**1905**	**2010**	1	KT
		50	14·22	35·42	26·47	—	—	—	**N 70 H**	90	**1855**	**2005**	1	
		75	13·82	35·37	26·53	—	—	—	,,	180	**1905**	**2010**	1	KT
		100	12·76	35·17	26·59									
		150	10·78	34·88	26·74									
		200	9·50	34·74	26·86									
		250	8·30	34·65	26·98									
95	17	0	15·26	35·43	26·26	8·35	30	—	**N 70 V**	50–0	**2230**			
		5	15·26	35·43	26·26	8·35	30	—	,,	100–50				
		10	15·26	35·44	26·27	8·35	30	—	,,	250–100				
		20	15·22	35·44	26·28	8·35	30		,,	420–250	—	**2330**		
		30	15·21	35·44	26·28	8·35	34	—	**N 100 H**	0–5	**0007**	**0050**	1	
		40	15·14	35·44	26·30	8·35	40	—	,,	70	**0005**	**0050**	1	
		50	14·66	35·44	26·40	8·35	40	—	,,	140	**0012**	**0055**	1	KT
		75	14·39	35·43	26·45	8·35	40	—	**N 70 H**	0–5	**0007**	**0050**	1	sample lost
		100	13·36	35·26	26·55	8·32	48	—	,,	70	**0005**	**0050**	1	
		150	11·86	35·07	26·69	8·30	64	—	,,	140	**0012**	**0055**	1	KT
		200	10·41	34·83	26·77	8·25	80							
		300	8·30	34·70	27·02	8·20	93							
		400	7·60	34·51	26·97	8·17	116							
96	18	0	15·11	35·48	26·34	—	—	—	**N 70 V**	50–0	0730	—	—	TD 16 m. (sunlight)
		5	15·11	35·48	26·34	—	—	—	,,	100–50				
		10	15·11	35·48	26·34	—	—	—	,,	250–100				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
96 *cont.*	33° 06′ 00″ S, 17° 01′ 00″ E	1926 24 ix										
97	33° 11′ 00″ S, 16° 55′ 30″ E	24 ix	1200	—	SW	3	SW	2	b.	1025·6	13·9	heavy SW swell
			1330	995 gl. oz.								
			1600	—	SW	3	SW	2	b.	1023·9	14·4	,,
98	33° 23′ 00″ S, 15° 50′ 00″ E	25 ix	0700	3640 gl. oz.								
			0800	—	W	4	W	3	o. d.	1020·4	11·1	heavy W swell
			1200	—	W	3	W	3	o. m. d.	1021·2	14·4	,,
			1600	—	S × W	3	S × W	3	c.	1020·2	15·0	heavy SW swell
99 A	33° 20′ 00″ to 33° 11′ 00″ S, 17° 17′ 00″ to 17° 26′ 00″ E	27 ix	0700	470 h.								
			0800	—	SE	5	SE	4	b.	1030·0	13·3	heavy conf. swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
96		20	15·11	35·48	26·34	—	—	—	**N 70 V**	500–250	—	0845		
cont.		30	15·11	35·48	26·34	—	—	—	**N 100 H**	0–5	1020	1135	1	
		40	15·11	35·48	26·34	—	—	—	,,	90	1025	1135	1	
		50	15·11	35·46	26·33	—	—	—	,,	180	1030	1130	1	KT
		75	14·66	35·44	26·40	—	—	—	**N 70 H**	0–5	1020	1135	1	
		100	14·11	35·33	26·44	—	—	—	,,	90	1025	1135	1	
		150	12·92	35·14	26·54	—	—	—	,,	180	1030	1130	1	KT
		200	12·49	35·05	26·54									
		300	12·11	34·81	26·45									
		400	10·28	34·60	26·61									
		600	4·78	34·38	27·21									
97	18	0	15·56	35·50	26·26	—	—	—	**N 70 V**	50–0	1340	—	—	TD 17 m.
		5	15·56	35·50	26·26	—	—	—	,,	100–50				
		10	15·51	35·50	26·27	—	—	—	,,	250–100				
		20	15·36	35·50	26·30	—	—	—	,,	500–250				
		30	15·29	35·46	26·29	—	—	—	,,	750–500	—	1540		
		40	15·11	35·44	26·31	—	—	—	**N 100 H**	0–5	1558	1645	1	
		50	14·81	35·44	26·35	—	—	—	,,	75(–0)	1555	1650	1	
		75	14·41	35·41	26·43	—	—	—	,,	150(–0)	1600	1655	1	KT
		100	13·59	35·30	26·51	—	—	—	**N 70 H**	75	1555	1650	1	
		150	12·38	35·02	26·54	—	—	—	,,	150(–75)	1600	1655	1	KT
		200	12·01	35·02	26·62									
		300	11·12	34·90	26·70									
		400	9·49	34·72	26·82									
		500	7·72	34·57	27·00									
		700	4·86	34·34	27·20									
		950	3·83	34·34	27·31									
98	19	0	15·61	35·52	26·26	8·35	34	—	**N 70 V**	50–0	0715			
		5	15·61	35·52	26·26	8·35	33	—	,,	100–50				
		10	15·61	35·52	26·26	8·35	30	—	,,	250–100				
		20	15·61	35·52	26·26	8·35	30	—	,,	500–250				
		30	15·61	35·52	26·26	8·35	34	—	,,	750–500				
		40	15·61	35·52	26·26	8·35	34	—	,,	1000–750				
		50	15·51	35·48	26·23	8·35	33	—	,,	2000–1500				
		75	14·62	35·43	26·40	8·35	38	—	,,	3000–2000	—	1300		
		100	13·91	35·30	26·46	8·32	44	—	**N 100 H**	0–5	1430	1512	1	
		150	12·51	35·06	26·55	8·32	53	—	,,	65	1428	1518	1	
		200	11·40	34·88	26·62	8·30	65	—	,,	130	1435	1520	1	KT
		300	10·50	34·85	26·76	8·30	76	—	**N 70 H**	0–5	1430	1512	1	net slightly torn
		400	8·71	34·63	26·91	8·30	84	—	,,	65	1428	1518	1	
		600	5·79	34·40	27·13	8·12	106	—	,,	130	1435	1520	1	KT
		800	3·36	34·23	27·26	8·07	114							
		1000	3·20	34·42	27·32	8·00	119							
		1500	2·78	34·65	27·65	7·96	129							
		2500	2·61	34·82	27·80	7·96	118							
		3500	2·16	34·82	27·84	7·96	119							
99 A	21	0	15·06	35·44	26·32	—	—	—	**N 100 H**	0–5	0900	0957	1	
		5	15·06	35·44	26·32	—	—	—	,,	90	,,	0952	1	
		10	15·06	35·44	26·32	—	—	—	,,	182	,,	0953	1	KT
		20	15·11	35·44	26·31	—	—	—	,,	266(–182)	,,	1015	1	
		30	15·11	35·44	26·31	—	—	—	,,	350(–266)	,,	1016	1	DGB
		40	15·11	35·45	26·32	—	—	—	**N 70 H**	0–5	1050	1106	¼	
		50	14·82	35·44	26·37	—	—	—	,,	85	,,	1104	¼	
		75	14·06	35·30	26·43	—	—	—	,,	170	,,	1105	¼	KT
		100	13·87	35·23	26·47	—	—	—	,,	247	,,	1105	¼	
		150	12·22	35·00	26·55	—	—	—	,,	325	,,	1106	¼	DGB
		200	11·10	34·85	26·65									
		300	8·86	34·66	26·90									
		395	7·00	34·52	27·06									

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
99 B	33° 20′ 00″ to 33° 11′ 00″ S, 17° 17′ 00″ to 17° 26′ 00″ E	27 ix	1200	—	SE	5	SE	4	b.	1029·1	13·9	heavy conf. swell
99 C	„ „	27 ix	1600	—	SE	6	SE	6	b.	1025·1	15·0	v. heavy conf. swel
99 D	„ „	27 ix	2000	—	SE	6	SE	6	b.	1024·8	12·8	heavy conf. swell bright starlight
99 E	„ „	27–28 ix	0000	—	SE	6	SE	6	b. c.	1022·0	15·0	heavy conf. swell moon rose 0105
99 F	„ „	28 ix	0400	—	SE	4	SE	4	b.	1021·2	14·4	heavy conf. swell
100	33° 20′ 00″ to 33° 46′ 00″ S, 15° 18′ 00″ to 15° 08′ 00″ E	30 ix	2000	—	—	0–1	—	0	b. c.	1025·8	13·9	heavy conf. swell
		30 ix–1 x	0000	—	SE	5	SE	4	b. c.	1025·4	13·9	heavy SE swell
		1 x	0800	—	SE	5	SE	5	b. c.	1023·1	13·3	mod. conf. swell
			1200	—	SE	5	SE	5	b. c.	1019·3	13·9	„
		2 x	0400	—	SW	2	—	1	b. c.	1011·8	13·9	„
			0800	—	WSW	5	WSW	4	b. c.	1011·9	13·9	„

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	*σt*	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
99 B	21	—	—	—	—	—	—	—	**N 100 H**	0–5	1230	1316	1	
									,,	70	,,	1313	1	
									,,	140	,,	1313	1	KT
									,,	215	,,	1314	1	
									,,	290	,,	1314	1	DGB
									N 70 H	0–5	1354	1406	¼	
									,,	65	,,	1404	¼	
									,,	130	,,	1404	¼	
									,,	202	,,	1405	¼	
									,,	275	,,	1405	¼	DGB
99 C	21	—	—	—	—	—	—	—	**N 100 H**	0–5	1654	1734	1	
									,,	80	,,	1733	1	
									,,	160	,,	1733	1	KT
									,,	230	,,	1734	1	
									,,	300	,,	1734	1	DGB
									N 70 H	0–5	**1832**	**1847**	¼	
									,,	77	,,	**1846**	¼	
									,,	155	,,	**1847**	¼	KT
									,,	232	,,	**1847**	¼	
									,,	310	,,	**1848**	¼	DGB
99 D	21	—	—	—	—	—	—	—	**N 100 H**	0–5	**2047**	**2131**	1	
									,,	52	,,	**2129**	1	
									,,	105	,,	**2130**	1	KT
									,,	167	,,	**2130**	1	
									,,	230	,,	**2131**	1	DGB
									N 70 H	0–5	**2209**	**2232**	¼	
									,,	47	,,	**2230**	¼	
									,,	95	,,	**2230**	¼	KT
									,,	147	,,	**2231**	¼	
									,,	200	,,	**2231**	¼	DGB
99 E	22	—	—	—	—	—	—	—	**N 100 H**	0–5	**0033**	**0104**	1	
									,,	51	,,	**0102**	1	KT
									,,	102	,,	**0102**	1	
									,,	163	,,	**0103**	1	
									,,	225	,,	**0103**	1	DGB
									N 70 H	0–5	**0143**	**0207**	½	
									,,	56	,,	**0203**	½	
									,,	112	,,	**0204**	½	KT
									,,	221	,,	**0204**	½	
									,,	330	,,	**0205**	½	DGB
99 F	22	—	—	—	—	—	—	—	**N 100 H**	0–5	**0435**	**0535**	1	
									,,	80	,,	**0534**	1	
									,,	160	,,	**0534**	1	KT
									,,	230(–0)	,,	**0535**	1	net slightly torn
									,,	300	,,	**0535**	1	DGB
									N 70 H	0–5	0612	0627	¼	
									,,	39	,,	0626	¼	
									,,	79(–0)	,,	0626	¼	KT
									,,	119	,,	0627	¼	
									,,	160	,,	0627	¼	DGB
100	24–28	—	—	—	—	—	—	—	**TYF**	0–5	**1925**	**2027**	2	A 30 ix
									,,	0–5	**2337**	**0038**	2·1	B 30 ix–1 x
									,,	0–5	0645	0746	1·5	C 1 x
									N 450	250	1320	1420	1·7	1 x. DGB
									TYF	450–550	0630	0832	3·3	C 2 x. DGB
									,,	475(–0)	0620	0832	3·3	2 x. DGB

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
100	33° 20′ 00″ to 33° 46′ 00″ S,	2 x	1600	—	N	4	N	4	o.	1013·8	13·9	mod. conf. swell
cont.	15° 18′ 00″ to 15° 08′ 00″ E	2–3 x	0000	—	N	3	N	4	b.	1016·5	13·9	,,
		3 x	0800	—	N	3	—	0	b.	1020·1	13·9	,,
		3–4 x	0000	—	NNW	5	NNW	4	b.	1014·0	13·3	mod. NW swell
		4 x	0800	—	NNW	6	NNW	5	o. m. r.	1008·9	13·9	mod. W swell
101	33° 50′ to 34° 13′ S, 16° 04′ to	14 x	1915	3734								
	15° 49′ E		2000	gl. oz.	—	0	—	0	b.	1015·6	13·3	v. heavy SW swe
			0000	—	WNW	3–4	WNW	3	b. c.	1015·7	13·9	mod. SW swell
		15 x	0800	—	W	4	W	3	o.	1015·1	13·9	,,
			1600	—	WSW	3	WSW	3	o. m. d.	1016·5	17·2	heavy SW swell
			0000	—	S × E	5	S × E	5	o.	1020·1	17·2	,,
102	35° 29′ 20″ S, 18° 33′ 40″ E	28 x	1000	1800 gl. oz.								
			1200	—	—	0	—	0	b. c.	1018·6	16·1	mod. SW swell
103	39° 04′ 00″ S, 17° 38′ 00″ E	30 x	0800	—	NW	6	NW	4	c.	1010·0	16·1	heavy conf. swell
			1200	—	NW	7–9	NW	5	o. r. g.	1009·4	16·7	heavy NW swell
104	41° 33′ 30″ S, 17° 58′ 00″ W	31 x	2000	—	SW	5–7	SW	6	b. c. q.	1010·0	7·9	v. heavy SW swe
			0000	—	SW	6–8	SW	6	o. r. g.	1010·0	7·2	,,
105	44° 32′ 00″ S, 18° 17′ 00″ E	3 xi	0800	-	SSW	7	SSW	8	o. g.	1017·3	3·3	v. heavy SW swe
			1200	—	SSW	6	SSW	7	c.	1022·1	4·4	,,
106	44° 42′ 30″ S, 17° 47′ 00″ E	3 xi	2000	-	SW × W	4	SW	3	o.	1027·4	3·3	heavy SW swell
			0000		WSW	4	SW	4	o.	1028·0	3·9	mod. SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	*σt*	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
100 *mt.*									**TYF**	625–675	1319	1530	–	D 2 x. DGB
									,,	1500–1550	**0045**	**0255**	3·6	B 2–3 x. DGT
									,,	260–310	0601	0801	2	C 3 x. DGB
									,,	900–1000	**2340**	**0140**	2·5	B 3–4 x
									,,	2500–2000	0745	0948	3	C 4 x
101	8	—	—	—	—	—	—	—	,,	2500(–0)	0745	0948	3	4 x
									N 450	2480–2580	**2022**	**2325**	3·3	14 x. DGT
									,,	1310–1410	0739	1040	2·5	15 x. DGT
									,,	850–950	1305	1610	4·3	15 x
	9	—	—	—	—	—	—	—	,,	350–400(–0)	**2042**	**2346**	6·2	15 x. DGB
102	22	0	15·46	35·36	26·17	8·35	—	—	**N 70 V**	50–0	1005	—	—	TD 17 m. (overcast)
		5	15·46	35·35	26·17	8·35	—	—	,,	100–50				
		10	15·42	35·36	26·18	8·35	—	—	,,	250–100				
		20	15·41	35·36	26·18	8·35	-	—	,,	500–250				
		30	15·31	35·35	26·19	8·35	—	—	,,	750–500				
		40	15·23	35·35	26·21	8·35	—	—	,,	1000–750	—	1156		
		50	15·12	35·37	26·25	8·35	—	—	**N 100 H**	0–5	1245	1317	1	
		75	13·57	35·26	26·57	8·35	—	—	,,	52	,,	1324	1	
		100	12·36	35·03	26·56	8·30	-	—	,,	104	,,	1325	1	KT
		150	11·80	34·97	26·63	8·29	—	—	**N 70 H**	0–5	1338	1348	¼	
		200	10·75	34·83	26·61	8·26	—	—	,,	48	,,	1345	¼	
		300	9·80	34·78	26·83	8·26	—	—	,,	97	,,	1346	¼	KT
		400	7·02	34·52	27·06	8·26								
		600	4·51	34·31	27·10	8·13								
		800	3·63	34·35	27·23	8·00								
		1200	2·84	34·57	27·58	7·98								
		1750	2·84	34·83	27·79	7·96								
103	24	0	18·92	35·52	25·46	8·40	—	—	**N 70 V**	50–0	0910			
		5	18·92	35·53	25·47	8·40	—	—	,,	100–50				
		10	18·92	35·53	25·47	8·40	—	—	,,	250–100				
		20	18·92	35·54	25·48	8·40	—	—	,,	500–250	—	1115		
		30	18·92	35·54	25·48	8·40	—	—	**N 100 H**	0–5	1303	1344	1	
		40	18·92	35·54	25·48	8·40	—	—	,,	78	,,	,,	1	
		50	18·92	35·54	25·48	8·40	—	—	,,	157	,,	,,	1	KT
		75	18·52	35·55	25·61	8·40								
		100	18·23	35·61	25·70	8·40								
		150	17·86	35·54	25·75	8·40								
		200	16·69	35·54	26·02	8·38								
		300	15·24	35·47	26·30	8·33								
		400	13·51	35·34	26·36	8·29								
		500	13·26	35·33	26·41	8·26								
		1200	5·06	34·36	27·14	8·00								
104	25	—	—	—	—	—	—	—	**N 100 H**	0–5	**2118**	**2147**	1	
									,,	56(–0)	,,	,,	1	
									,,	112	,,	,,	1	KT
									N 70 H	0–5	**2212**	**2227**	¼	
									,,	55	,,	**2224**	¼	
									,,	110	,,	**2225**	¼	KT
105	27	—	—	—	—	—	—	—	**N 100 H**	0–5	1000	1033	1	
									,,	58(–0)	,,	1030	1	
									,,	117	,,	1031	1	KT
									N 70 H	62	1054	1101	¼	
									,,	124	,,	,,	¼	KT
106	27	—	—	—	—	—	—	—	**N 100 H**	0–5	**2113**	**2143**	1	
									,,	62	,,	**2141**	1	
									,,	124	,,	**2142**	1	KT
									N 70 H	0–5	**2200**	**2210**	¼	
									,,	63	,,	,,	¼	
									,,	126	,,	,,	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
107	45° 03′ 00″ S, 17° 03′ 00″ E	4 xi	0800	—	W × N	5	NW	4	o.	1023·5	5·0	mod. SW swell
			1200	—	W × S	5	W × S	5	o.	1020·8	5·6	,,
			1600	—	NNW	5	NNW	4	o.	1017·9	6·7	mod. conf. swell
108	45° 44′ 00″ S, 15° 38′ 30″ E	5 xi	0800	—	W	5	W	4	o.	1009·3	4·4	v. heavy W swell
			1200	—	W	5	W × N	6	c.	1007·8	5·5	,,
109	46° 25′ 00″ S, 15° 13′ 00″ E	5 xi	2000	—	SW×W	3	SW	4	c.	1004·8	9·4	v. heavy W swell
			0000	—	SW×W	4	SW	4	o.	1001·8	6·7	mod. SW swell
110	47° 54′ 00″ S, 12° 39′ 30″ E	7 xi	0800	—	NW	4	NW	4	o. d.	984·4	2·9	mod. NW swell
			1200	—	W × S	4	NNW	4	c.	986·6	3·3	,,
111	48° 12′ 00″ S, 12° 31′ 00″ E	7 xi	2000	—	SSW	5	SSW	5	o. d.	993·8	1·7	heavy SW swell
			0000	—	SSW	6	SW	6	o.	999·8	1·1	,,
112	49° 31′ 00″ S, 10° 48′ 00″ E	9 xi	0800	—	W × N	6	W × N	6	o. g.	985·0	2·2	heavy NW swell
			1200	—	W × N	6	W × N	6	o. g.	995·3	2·2	,,
113	50° 09′ 00″ S, 10° 21′ 00″ E	9 xi	2000	—	W × N	6	W × N	5	o. s.	991·8	1·1	heavy W swell
			0000	—	W × N	7	W × N	6	o. q.	992·9	1·1	mod. W swell
114	52° 25′ 00″ S, 9° 50′ 00″ E	12 xi	0800	—	SW	4	SW	2	c. g.	999·7	−2·2	heavy NW swell
			1200	—	SW × S	4	SW × S	5	c. g.	1003·0	−1·1	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
107	28	0	5·91	34·02	26·81	8·35	—	—	**N 70 V**	50–0	0910	—	—	TD 17 m. (overcast)
		5	5·91	33·99	26·79	8·35	—	—	,,	100–40				
		10	5·91	34·02	26·81	8·35	—	—	,,	250–80				
		20	5·90	34·02	26·81	8·35	—	—	,,	500–250				
		30	5·90	34·02	26·81	8·35	—	—	,,	750–500				
		40	5·90	34·02	26·81	8·35	—	—	,,	1000–750	—	1150		
		50	5·90	34·02	26·81	8·35	—	—	**N 450**	850–950	1315	1520	3	DGB
		75	5·90	34·02	26·81	8·35								
		100	5·75	34·00	26·81	8·30								
		150	4·91	33·96	26·88	8·28								
		200	4·60	34·00	26·94	8·28								
		300	4·30	34·20	27·14	8·17								
		400	3·96	34·20	27·17	8·10								
		600	3·24	34·22	27·16	8·04								
		800	2·96	34·29	27·34	7·96								
		1500	3·61	34·20	27·11	7·96								
		2000	3·65	34·27	27·26	7·96								
		3000	2·62	34·54	27·58	7·96								
108	1	—	—	—	—	—	—	—	**N 100 H**	0–5	0941	1004	1·1	
									,,	45(–0)	,,	,,	1·1	
									,,	91(–0)	,,	,,	1·1	KT
									N 70 H	0–5	1029	1039	¼	
									,,	60	,,	,,	¼	
									,,	120	,,	,,	¼	KT
109	1	—	—	—	—	—	—	—	**N 100 H**	0–5	**2118**	**2218**	1	
									,,	96	,,	,,	1	
									,,	192	,,	,,	1	KT
									N 70 H	0–5	**2236**	**2248**	¼	
									,,	70	,,	**2246**	¼	
									,,	140	,,	,,	¼	KT
110	3	—	—	—	—	—	—	—	**N 100 H**	0–5	0907	0942	1	
									,,	89	,,	,,	1	
									,,	178	,,	,,	1	KT
									N 70 H	0–5	1005	1015	¼	
									,,	75	,,	,,	¼	
									,,	150	,,	,,	¼	
111	3	—	—	—	—	—	—	—	**N 100 H**	0–5	**2109**	**2139**	1	
									,,	65	,,	,,	1	
									,,	130	,,	,,	1	KT
									N 70 H	0–5	**2207**	**2219**	¼	
									,,	84	,,	,,	¼	
									,,	168	,,	,,	¼	KT
112	5	—	—	—	—	—	—	—	**N 100 H**	0–5	0934	1028	1	
									,,	58	,,	,,	1	
									,,	117	,,	,,	1	KT
									N 70 H	0–5	1045	1102	¼	
									,,	53	,,	,,	¼	
									,,	107	,,	,,	¼	KT
113	5	—	—	—	—	—	—	—	**N 100 H**	0–5	**2110**	**2135**	1	
									,,	40	,,	,,	1	
									,,	81	,,	,,	1	KT
									N 70 H	0–5	**2152**	**2205**	¼	
									,,	37	,,	,,	¼	
									,,	74	,,	,,	¼	KT
114	8	745	2·08	34·67	27·72	—	—	—	**N 100 H**	0–5	0916	1015	1	
									,,	90	,,	,,	1	
									,,	180(–90)	,,	,,	1	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
114 *cont.*	52° 25′ 00″ S, 9° 50′ 00″ E	12 xi	1600	—	SW × S	4	SW × S	5	c.	1007·1	− 1·7	heavy NW swell
115	52° 39′ 00″ S, 9° 33′ 00″ E	12 xi	2000	—	SW×W	4	SW×W	3	b. c.	1011·3	1·7	heavy NW swell
			0000	—	SW×W	3	SW×W	3	b. c.	1007·8	− 2·2	mod. NW swell
116	54° 30′ 00″ S, 5° 34′ 00″ E	14 xi	2000	—	NW×W	6	NW	1	o. f.	976·6	0·0	
			0000	—	NW×W	6	NW	2	o. f.	974·8	− 0·6	
117	About 5 miles N 72° E of Bouvet I, 54° 20′ 40″ S, 3° 48′ 45″ E	17 xi	1200	—	WSW	4	WSW	4	o. s. g.	1003·5	− 3·9	
			1230	1723 di. oz.								
			1600	—	WSW	2	—	1	o. s. g.	1002·1	− 3·3	heavy NW swell
118	53° 07′ 00″ S, 1° 26′ 00″ W	19 xi	0800	—	S × E	4	S × E	3	o.	995·3	− 2·8	mod. E swell
			1200	—	W × S	3	E × S	4	o.	1001·0	− 1·1	slight ESE swell
119	53° 02′ 00″ S, 1° 56′ 00″ W	19 xi	2000	—	NW	4	NW	3	o. s. g.	1003·4	− 0·6	
			0000	—	N × W	5	NW	4	o. s. g.	1004·2	− 1·1	
120	51° 44′ 00″ S, 5° 19′ 00″ W	22 xi	1200	—	SSW	7	SW	5	o. s.	1013·2	− 1·1	heavy W swell
121	50° 59′ 00″ S, 11° 44′ 00″ W	25 xi	2000	—	NW×W	4	NW×W	2	o.	1018·5	1·1	mod. W swell
			0000	—	NW×W	5	NW×W	4	o. f. r.	1017·9	1·1	,,
122	Maiviken, W Cumberland Bay, S Georgia	14 xii	1200	—	—	0	—	0	b. c.	1000·7	13·3	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
114									**N 70 H**	0–5	1036	1104	? ¼	
nt.									,,	91	,,	,,	? ¼	
									,,	183	,,	,,	? ¼	KT
									N 450	650–700	1154	1354		DGT
115	8	—	–	—	—	—	—	—	**N 100 H**	0–5	**2109**	**2133**	1	
									,,	53	,,	,,	1	
									,,	106	,,	,,	1	KT
									N 70 H	0–5	**2153**	**2202**	¼	
									,,	40(–0)	,,	,,	¼	
									,,	80(–0)	,,	,,	¼	KT
116	10	—	—	—	—	—	—	—	**N 100 H**	0–5	**2020**	**2050**	1	
									,,	55	,,	,,	1	
									,,	110(–0)	,,	,,	1	KT
									N 70 H	0–5	**2115**	**2125**	¼	
									,,	69	,,	,,	¼	
									,,	139	,,	,,	¼	KT
117	13	0	– 1·58	33·86	27·26	8·12	—	—	**N 70 V**	50–0	1230			
		5	– 1·55	33·93	27·34	8·07	—	—	,,	100–50				
		10	– 1·55	34·20?	27·54?	8·07	—	—	,,	250–100				
		20	– 1·55	33·87	27·28	8·07	—	—	,,	500–300				
		30	– 1·55	33·82	27·24	8·07	—	—	,,	750–500	—	1440		
		40	1·55	34·02	27·40	8·07	—	—	**N 100 H**	0–5	1505	1532	1	
		50	– 1·55	33·93	27·34	8·07	—	—	,,	49	,,	,,	1	
		75	1·45	34·05	27·41	8·03	—	—	,,	90(–0)	,,	,,	1	KT
		100	– 1·43	34·07	27·43	7·97	—	—	**N 70 H**	0–5	1550	1601	¼	
		150	0·45	34·47	27·67	7·97	–		,,	58	,,	,,	¼	
		200	1·10	34·56	27·70	7·95			,,	117(–20)	,,	,,	¼	KT
		300	1·45	34·64	27·74	7·95								
		400	1·45	34·69	27·78	7·95								
118	15	—	—	—	—		—	—	**N 100 H**	0–5	0919	1001	1	
									,,	100	,,	,,	1	
									,,	200	,,	,,	1	KT
									N 70 H	0–5	1021	1035	¼	
									,,	91	,,	,,	¼	
									,,	182	,,	,,	¼	KT
119	15	—	—	—	—	—	—	—	**N 100 H**	0–5	**2034**	**2108**	1	
									,,	90	,,	,,	1	
									,,	180	,,	,,	1	KT
									N 70 H	0–5	**2128**	**2137**	¼	
									,,	90	,,	,,	¼	
									,,	180	,,	,,	¼	
120	18	—	—		–	—	—		**N 100 H**	340–360(–0)	1115	1327	6·4	
									,,	575–675	1115	1334	6·4	DGB
121	20	—	—	—	—		—	—	**N 100 H**	0–5	**2108**	**2137**	1	
									,,	58	,,	,,	1	
									,,	117	,,	,,	1	KT
									N 70 H	0–5	**2155**	**2203**	¼	
									,,	67	,,	,,	¼	
									,,	134	,,	,,	¼	KT
122	10	0	4·65		—	—		—	**N 70 H**	0–1		–	—	in upper freshwater lake
		½	4·1											
		1	2·4											
		0	3·4				—		**N 70 H**	0–1				in lower freshwater lake
		0	3·7											
									Sh. coll.					Maiviken beach

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
123	Off mouth of Cumberland Bay, S Georgia. From 4·1 miles N 54° E of Larsen Pt, to 1·2 miles S 62° W of Merton Rock	15 xii	1200	—	NE	3	NE	2	b. c. m.	1005·7	2·8	
			1305	250 gy. m.								
			1525	230								
			1600	gy. m.	NE	3	—	0	o. m.	1003·5	2·2	
124	53° 45′ 30″ S, 36° 32′ 30″ W	18 xii	1600	220 gy. m.	NE	4	NE	3	o. s.	1001·4	1·7	
125	53° 28′ 30″ S, 36° 20′ 30″ W	18–19 xii	2300	3140								
			0000	—	ENE	4	ENE	3	o.	1005·7	0·6	
			0400	—	S × W	4	SW	3	b. c.	1005·9	1·1	
126	53° 58′ 30″ S, 37° 08′ 00″ W	19 xii	1055	100 c. blk. s. m.								
			1200	—	NE	2	NE	2	o. s.	1008·5	1·7	
127	53° 48′ 30″ S, 37° 08′ 00″ W	19 xii	1345	157 gn. m. blk. spk.								
			1600	—	—	0–1	—	0	c.	1007·9	2·8	slight W swell
128	53° 38′ 30″ S, 37° 08′ 00″ W	19 xii	1710	167 r.	—	0	—	0	o. v.	1007·9	1·1	slight W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
23	11	0	1·05	33·77	27·07	—	—	—	**OTL**	230–250	1315	1445	5·7	
		240	− 0·20	34·04	27·36	—	—	—	**N 7–T**					
		0	2·15	32·70	26·14	—	—	—	**N 4–T**					
		220	1·15	33·77	27·06	—	—	—	**NCS–T**					
24	14	0	1·80	33·78	27·03	8·30	144?	7·58	**N 50 V**	100–0	1600			
		5	1·80	33·78	27·03	8·30	126?	7·54	**N 70 V**	50–0				
		10	1·70	33·78	27·04	8·30	88	7·56	,,	100–50				
		20	1·47	33·78	27·04	8·30	88	7·57	,,	210–100	—	1650		
		30	1·10	33·80	27·09	8·30	84	7·66	**N 100 H**	0–5	1742	1821	1	
		40	1·05	33·80	27·10	8·28	86	7·54	,,	90	,,	,,	1	
		50	0·82	33·80	27·11	8·28	91	7·56	,,	180(–90)	,,	,,	1	KT
		75	0·20	33·86	27·19	8·28	96	7·58	**N 70 H**	0–5	1838	1847	¼	
		100	− 0·75	33·91	27·29	8·16	111	7·38	,,	65	,,	,,	¼	
		150	− 0·10	34·09	27·39	8·00	116	6·47	,,	130	,,	,,	¼	KT
		200	0·60	34·23	27·47	7·96	125	5·46						
25	14	0	1·45	33·82	27·09	8·30	90	—	**N 50 V**	100–0	**2300**			
		10	1·43	33·82	27·09	8·30	94	—	**N 70 V**	50–0				
		20	1·20	33·82	27·11	8·30	93	—	,,	100–50				
		30	1·10	33·82	27·11	8·30	91	—	,,	250–100				
		40	1·00	33·86	27·14	8·30	90	—	,,	500–250				
		50	0·85	33·86	27·15	8·30	94	—	,,	750–500				
		60	0·52	33·86	27·17	8·30	93	—	,,	1000–750	—	**0150**		
		80	− 0·20	33·91	27·26	8·19	101	—	**N 100 H**	0–5	**0204**	**0243**	1	
		100	− 0·50	34·00	27·32	8·04	105	—	,,	70	,,	,,	1	
		150	0·36	34·18	27·46	7·98	110	—	,,	140	,,	,,	1	KT
		200	1·50	34·36	27·51	7·95	116	—	**N 70 H**	0–5	**0302**	**0317**	¼	
		300	1·85	34·49	27·59	7·90	124	—	,,	70	,,	,,	¼	
		400	2·02	34·58	27·66	7·92	125	—	,,	140	,,	,,	¼	KT
		600	2·03	34·63	27·70	7·92	125							
		800	1·92	34·68	27·74	7·98	119							
		1000	1·82	34·72	27·78	7·98	116							
		1500	1·61	34·74	27·82	7·98	121							
26	15	0	1·28	33·77	27·05	8·30	99	—	**N 50 V**	100–0	1055	—	—	net touched bottom
		5	0·76	33·80	27·11	8·15	100	—	,,	80–0				
		10	0·30	33·86	27·18	8·10	108	—	**N 70 V**	50–0				
		20	− 0·15	33·86	27·21	8·08	105	—	,,	100–50	—	1120		
		30	− 0·18	33·87	27·23	8·08	108	—	**N 100 H**	0–5	1144	1203	1	
		40	− 0·25	33·87	27·23	8·08	106	—	,,	23	,,	,,	1	
		50	− 0·40	33·89	27·25	8·08	110	—	,,	47	,,	,,	1	KT
		60	− 0·55	33·89	27·26	8·05	111	—	**N 70 H**	0–5	1214	1222	¼	
		80	− 0·65	33·93	27·29	8·00	115	—	,,	22	,,	,,	¼	
		95	− 0·60	33·95	27·31	8·00	119	—	,,	44(–0)	,,	,,	¼	KT
27	15	0	1·92	33·77	27·01	8·30	100	7·51	**N 50 V**	100–0	1345			
		5	1·60	33·77	27·03	8·30	99	7·51	**N 70 V**	50–0				
		10	1·45	33·78	27·06	8·28	98	7·60	,,	100–50				
		20	1·28	33·77	27·05	8·28	96	7·62	,,	150–110	—	1407		
		30	0·89	33·78	27·10	8·28	95	7·64	**N 100 H**	0–5	1452	1519	1	
		40	0·70	33·80	27·12	8·26	96	7·78	,,	41	,,	,,	1	
		50	− 0·35	33·86	27·22	8·04	108	7·60	,,	82	,,	,,	1	KT
		60	− 0·61	33·87	27·25	8·00	108	7·55	**N 70 H**	0–5	1530	1538	¼	
		80	− 0·71	33·89	27·27	8·00	111	7·17	,,	38	,,	,,	¼	
		100	− 0·60	33·98	27·34	7·96	114	6·90	,,	79	,,	,,	¼	KT
		150	− 0·50	34·04	27·37	7·96	115	6·59						
28	15	0	1·48	33·84	27·10	8·30	92	—	**N 50 V**	100–0	1710			
		5	1·40	33·84	27·10	8·30	91	—	**N 70 V**	50–0				
		10	1·35	33·84	27·11	8·30	91	—	,,	100–50				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
128 *cont.*	53° 38′ 30″ S, 37° 08′ 00″ W	1926 19 xii										
129	53° 28′ 30″ S, 37° 08′ 00″ W	19 xii	2000	—	—	0	—	0	0. v.	1010·2	1·1	slight W swell
			2015	1001 blk. s. gn. m. st.								
			0000	—	—	0–1	—	0	0	1011·3	1·1	,,
130	54° 06′ 00″ S, 36° 23′ 00″ W	20 xii	0800	—	SW	2	SW	2	b.	1009·3	2·2	slight W swell
			1033	122 gn. m.								
			1200	—	NW	2	NW	3	b. c.	1005·5	6·1	,,
131	53° 59′ 30″ S, 36° 11′ 00″ W	20 xii	1325	240 gy. m. st.								
			1600	—	W	5	W	4	b. c.	1003·1	5·6	mod. W swell
132	53° 52′ 00″ S, 35° 58′ 30″ W	20 xii	1700	180 h.								
			2000	—	W	5	W	4	o.	1000·7	1·7	mod. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
28		20	1·28	33·84	27·11	8·26	90	—	**N 70 V**	160–100	—	1748		
nt.		30	0·72	33·84	27·15	8·18	99	—	**N 100 H**	0–5	1809	1831	1	
		40	0·30	33·84	27·17	8·14	103	—	,,	50(–0)	,,	,,	1	
		50	0·00	33·87	27·22	8·06	104	—	,,	100	,,	,,	1	KT
		60	– 0·10	33·86	27·20	8·04	104	—	**N 70 H**	0–5	1844	1851	¼	
		80	– 0·51	33·89	27·26	7·96	109	—	,,	47	,,	,,	¼	
		100	– 0·55	33·98	27·34	7·96	115	—	,,	95	,,	,,	¼	KT
		130	– 0·50	34·02	27·36	7·94	116							
		160	– 0·25	34·07	27·39	7·94	124							
29	15	0	1·75	33·82	27·07	8·30	99	7·64	**N 50 V**	100–0	2015			
		5	1·60	33·82	27·08	8·30	103	7·60	**N 70 V**	50–0				
		10	1·50	33·82	27·08	8·30	106	7·64	,,	100–50				
		20	1·30	33·82	27·10	8·30	98	7·62	,,	250–100				
		30	0·92	33·84	27·13	8·30	95	7·60	,,	500–250				
		40	0·75	33·86	27·15	8·30	93	7·62	,,	780–500				
		50	0·47	33·86	27·17	8·24	93	7·60	,,	950–750	—	**2228**		
		60	0·35	33·87	27·20	8·16	101	7·58	**N 100 H**	0–5	**2250**	**2310**	1	
		80	0·01	33·87	27·22	8·10	94	7·51	,,	42(–0)	,,	,,	1	net torn
		100	– 0·37	33·91	27·27	8·04	106	7·52	,,	84(–0)	,,	,,	1	KT
		150	– 0·55	34·04	27·38	7·98	111	6·81	**N 70 H**	0–5	**2328**	**2339**	¼	
		200	1·01	34·30	27·50	7·96	116	5·18	,,	44	,,	,,	¼	
		300	1·90	34·49	27·59	7·90	121	4·22	,,	88(–0)	,,	,,	¼	
		400	2·03	34·54	27·70	7·96	121	4·12						
		600	2·00	34·65	27·78	7·96	125	4·12						
		800	1·94	34·68	27·73	7·96	130	4·42						
		950	1·92	34·70	27·77	7·96	134	4·08						
30	16	0	1·85	32·14	25·72	8·32	83	—	**N 50 V**	100–0	1033			
		5	1·78	33·39	26·73	8·32	85	—	**N 70 V**	50–0				
		10	1·75	33·71	26·98	8·32	95	—	,,	115–50	—	1045		
		20	1·45	33·77	27·04	8·30	93	—	**N 100 H**	0–5	1121	1147	1	
		30	1·15	33·77	27·06	8·30	93	—	,,	38	,,	,,	1	
		40	0·97	33·80	27·10	8·22	89	—	,,	77	,,	,,	1	KT
		50	0·22	33·82	27·17	8·18	98	—	**N 70 H**	0–5	1159	1209	¼	
		60	0·02	33·86	27·20	8·08	103	—	,,	37	,,	,,	¼	
		80	– 0·20	33·89	27·24	8·00	106	—	,,	75	,,	,,	¼	
		100	– 0·31	33·91	27·27	8·00	108							
		120	– 0·30	33·93	27·27	8·00	114							
31	16	0	1·95	33·82	27·05	8·30	91	7·43	**N 50 V**	100–0	1325			
		5	1·85	33·84	27·07	8·30	86	7·37	**N 70 V**	50–0				
		10	1·72	33·84	27·08	8·30	91	7·45	,,	100–50				
		20	1·22	33·84	27·11	8·30	93	7·73	,,	230–100	—	1420		
		30	1·01	33·84	27·13	8·26	93	7·68	**N 100 H**	0–5	1430	1508	1	
		40	0·94	33·84	27·13	8·26	95	7·48	,,	64	,,	,,	1	
		50	0·88	33·86	27·15	8·20	96	7·44	,,	128	,,	,,	1	KT
		60	0·50	33·87	27·19	8·16	99	7·48	**N 70 H**	0–5	1522	1532	¼	
		80	– 0·65	33·91	27·28	8·09	108	7·36	,,	62	,,	,,	¼	
		100	– 0·63	33·95	27·31	8·03	113	7·41	,,	124	,,	,,	¼	KT
		150	– 0·28	34·04	27·36	7·98	118	6·76						
		200	0·12	34·13	27·41	7·98	121	6·11						
		240	0·81	34·27	27·49	7·98	125	5·27						
32	16	0	1·45	33·86	27·11	8·30	105	—	**N 50 V**	100–0	1700			
		5	1·30	33·87	27·14	8·30	99	—	**N 70 V**	50–0				
		10	1·25	33·86	27·12	8·30	100	—	,,	100–50				
		20	1·25	33·87	27·14	8·30	99	—	,,	170–125				
		30	0·45	33·90	27·21	8·26	100	—	,,	170–0	—	1750		
		40	0·20	33·90	27·23	8·20	103	—	**N 100 H**	0–5	1804	1825	1	
		50	0·05	33·91	27·25	8·15	105	—	,,	38	,,	,,	1	
		60	– 0·21	33·96	27·30	8·04	116	—	,,	76(–0)	,,	,,	1	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
132 *cont.*	53° 52′ 00″ S, 35° 58′ 30″ W	1926 20 xii										
133	53° 45′ 30″ S, 35° 46′ 30″ W	20–21 xii	2012 0000	802 h. —	W	6–7	W	6	o.	1000·2	1·1	slight W swell
134	54° 22′ 00″ S, 35° 56′ 00″ W	21 xii	1200 1440 1600	— 176 gy. m. —	WNW NE	3 2	WNW NE	3 2	b. c. o.	995·9 994·7	2·8 1·7	
135	54° 22′ 00″ S, 35° 39′ 00″ W	21 xii	1805 2000	243 gn. m. —	E	2	E	1	o. m.	994·7	1·7	
136	54° 22′ 00″ S, 35° 21′ 00″ W	21 xii	2138 0000	246 blk. st. m. —	E	2	E	1	o. f.	993·0	0·0	
137	54° 19′ 30″ S, 35° 03′ 30″ W	22 xii	0307 0400	740 r. —	—	0–1	—	0	o. f.	992·1	0·0	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
32		80	− 0·40	33·96	27·31	8·04	116	—	**N 70 H**	0–5	1839	1847	¼	
nt.		100	− 0·31	33·99	27·33	7·97	118	—	,,	45	,,	,,	¼	
		140	− 0·10	34·08	27·38	7·97	120	—	,,	90	,,	,,	¼	KT
		175	0·20	34·16	27·44	7·97	123							
33	16	0	0·50	33·80	27·13	8·16	95	8·02	**N 50 V**	100–0	2012			
		5	0·50	33·80	27·13	8·16	94	7·65	**N 70 V**	50–0				
		10	0·50	33·80	27·13	8·16	95	7·64	,,	100–50				
		20	0·50	33·80	27·13	8·16	105	7·65	,,	270–100				
		30	0·45	33·80	27·13	8·16	96	7·75	,,	500–250				
		40	0·50	33·82	27·15	8·16	101	7·77	,,	750–500	—	**2350**		
		50	0·50	33·82	27·15	8·16	104	7·65	**N 100 H**	0–5	**0012**	**0119**	1	
		60	0·00	33·82	27·18	8·16	104	—	,,	50	,,	,,	1	
		80	− 1·00	33·91	27·29	8·02	105	7·32	,,	100	,,	,,	1	KT
		100	− 0·68	33·96	27·32	8·00	110	6·97	**N 70 H**	0–5	**0136**	**0154**	¼	
		150	0·22	34·09	27·38	7·96	114	6·20	,,	48	,,	,,	¼	
		250	1·81	34·47	27·58	7·96	118	4·55	,,	97	,,	,,	¼	KT
		350	1·92	34·49	27·59	7·96	119	4·38						
		500	2·08	34·58	27·66	8·00	118	4·54						
		600	2·02	34·59	27·67	8·00	120	4·18						
		750	1·95	34·59	27·67	8·07	123	4·34						
34	17	0	2·41	33·51	26·78	8·30	94	├	**N 50 V**	100–0	1440			
		5	2·41	33·53	26·79	8·30	94	├	**N 70 V**	50–0				
		10	2·29	33·55	26·82	8·30	93	├	,,	100–50				
		20	1·22	33·70	27·00	8·30	89	—	,,	170–100	—	1502		
		30	1·10	33·78	27·08	8·30	90	—	**N 100 H**	0–5	1530	1604	1	
		40	1·05	33·78	27·09	8·24	91	—	,,	61	,,	,,	1	
		50	0·80	33·78	27·10	8·20	94	—	,,	123	,,	,,	1	KT
		60	0·72	33·80	27·12	8·15	89	—	**N 70 H**	0–5	1617	1630	¼	
		80	0·42	33·82	27·15	8·10	99	—	,,	60	,,	,,	¼	
		100	0·23	33·87	27·20	8·10	106	—	,,	120	,,	,,	¼	KT
		130	0·10	33·82	27·17	8·05	111							
		165	0·00	33·88	27·22	8·05	114							
35	17	0	1·88	33·78	27·03	8·30	90	7·44	**N 50 V**	100–0	1805			
		10	1·85	33·79	27·03	8·30	85	7·45	**N 70 V**	50–0				
		20	1·80	33·78	27·03	8·24	85	7·47	,,	100–50				
		30	1·40	33·79	27·06	8·24	86	7·54	,,	230–100	—	1830		
		40	1·21	33·87	27·15	8·20	89	7·60	**N 100 H**	0–5	1902	1931	1	
		50	0·88	33·87	27·17	8·20	90	7·53	,,	75	,,	,,	1	
		60	0·72	33·89	27·19	8·20	98	7·53	,,	150	,,	,,	1	KT
		80	0·22	33·89	27·21	8·12	100	7·53	**N 70 H**	0–5	1944	1959	¼	
		100	0·09	33·89	27·22	8·06	94	7·57	,,	64	,,	,,	¼	
		140	0·22	33·93	27·27	8·00	111	7·21	,,	128	,,	,,	¼	KT
		180	0·21	34·05	27·36	8·00	115	6·57						
		220	0·88	34·25	27·47	7·96	120	5·58						
36	17	0	1·40	33·87	27·13	8·30	118?	—	**N 50 V**	100–0	**2138**			
		10	1·32	33·88	27·14	8·30	103	—	**N 70 V**	50–0				
		20	1·09	33·88	27·15	8·30	105	—	,,	100–50				
		30	0·72	33·89	27·19	8·30	105	—	,,	235–100	—	**2210**		
		40	0·70	33·89	27·19	8·30	103	—	**N 100 H**	0–5	**2234**	**2301**	1	
		50	0·50	33·89	27·20	8·17	105	—	,,	49	,,	,,	1	
		60	0·45	33·91	27·22	8·17	103	—	,,	99(−0)	,,	,,	1	KT
		80	0·01	33·96	27·29	8·07	116	—	**N 70 H**	0–5	**2317**	**2330**	¼	
		100	− 0·20	34·04	27·36	8·00	120	—	,,	48	,,	,,	¼	
		150	0·20	34·13	27·41	7·96	123	—	,,	96	,,	,,	¼	KT
		210	1·72	34·47	27·65	7·96	125							
37	18	0	1·22	33·84	27·11	8·30	90	7·76	**N 50 V**	100–0	**0307**			
		10	1·20	33·84	27·12	8·30	93	7·73	**N 70 V**	50–0				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1926										
137 *cont.*	54° 19′ 30″ S, 35° 03′ 30″ W	22 xii										
138	54° 17′ 00″ S, 34° 47′ 00″ W	22 xii	0800	2530 r.	NE	1	—	1	c.	998·1	1·1	
			1200	—	ENE	3	ENE	3	c.	992·3	2·8	
139	53° 30′ 15″ S, 35° 50′ 45″ W	22–23 xii	2000	—	NW	1	—	1	b. c. f.	994·2	1·7	heavy NW swell
			2200	3230 r.								
			0000	—	WNW	6	NW	6	c.	991·9	1·1	,,
140	Stromness Hr to Larsen Pt, S Georgia. From 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W	23 xii	1440	136								
			1600	gn. m. st.	NW	4	NW	4	o. r.	989·6	2·2	slight NW swell
			1800	122 gn. m. st.								
141	E Cumberland Bay, S Georgia, 200 yds from shore, under Mt Duse	29 xii	1453	22 m.								
			1527	27 m.								
			1545	17 m.								
			1600	—	NW	3–6	NW	1	b. c.	1001·4	8·9	
142	E Cumberland Bay, S Georgia. From 54° 11′ 30″ S, 36° 35′ W to 54° 12′ S, 36° 29′ 30″ W	30 xii	1200	—	NE	5	NE	2	o. r. g.	973·0	7·22	
			1300	88 m.								
			1450	273 m.								
143	Off mouth of E Cumberland Bay, S Georgia, 54° 12′ S, 36° 29′ 30″ W	30 xii	1450	273 m.								
			1600	—	SW	9	SW	7	o. r. g.	972·0	4·4	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
37		20	0·83	33·84	27·14	8·30	98	7·83	**N 70 V**	100–50				
ut.		30	0·35	33·84	27·17	8·30	103	7·67	,,	250–100				
		40	0·30	33·84	27·17	8·25	103	7·69	,,	500–250				
		50	0·20	33·84	27·18	8·20	103	7·69	,,	700–500	—	0515		
		60	0·15	33·86	27·19	8·15	99	7·69	**N 100 H**	0–5	0528	0600	1	
		80	− 0·20	33·91	27·26	8·10	101	7·49	,,	66	,,	,,	1	
		100	− 0·20	33·96	27·30	8·05	113	6·92	,,	132	,,	,,	1	KT
		150	0·51	34·14	27·41	8·00	120	5·96	**N 70 H**	0–5	0612	0626	¼	
		200	1·36	34·33	27·50	7·95	125	5·11	,,	60	,,	,,	¼	
		300	1·90	34·47	27·58	7·95	129	4·30	,,	120	,,	,,	¼	KT
		500	1·94	34·60	27·68	7·95	121	4·32						
		700	1·86	34·69	27·75	7·98	123	4·33						
38	18	0	1·20	33·84	27·12	8·30	95	—	**N 50 V**	100–0	0800	—	—	net split
		10	0·85	33·84	27·14	8·30	91	—	**N 70 V**	50–0				
		20	0·75	33·84	27·15	8·30	91	—	,,	100–50				
		30	0·48	33·84	27·16	8·20	96	—	,,	250–100				
		40	0·15	33·86	27·19	8·20	103	—	,,	500–250				
		50	− 0·02	33·86	27·20	8·15	104	—	,,	750–500				
		60	− 0·38	33·87	27·24	8·10	105	—	,,	1000–750				
		80	− 0·55	33·91	27·28	8·05	109	—	,,	2000–1000	—	1050		
		100	− 0·40	33·98	27·33	8·00	119	—	**N 100 H**	0–5	1102	1140	1	
		150	1·22	34·28	27·46	7·95	125	—	,,	77	,,	,,	1	
		200	1·72	34·42	27·54	7·95	126	—	,,	155	,,	,,	1	KT
		300	1·94	34·52	27·62	7·95	126	—	**N 70 H**	0–5	1151	1205	¼	
		400	2·02	34·63	27·70	7·95	125	—	,,	74	,,	,,	¼	
		600	1·94	34·68	27·74	7·95	125	—	,,	148	,,	,,	¼	KT
		800	1·78	34·72	27·79	8·00	123							
		1000	1·64	34·72	27·80	7·98	125							
		1500	1·32	34·72	27·82	7·98	125							
		2000	0·90	34·71	27·84	7·98	125							
39	18	0	1·01	33·86	27·14	8·30	88	—	**N 70 V**	50–0	**2205**			
		10	1·01	33·87	27·16	8·30	90	—	,,	100–50				
		20	1·00	33·87	27·16	8·30	86	—	,,	250–150				
		30	0·72	33·87	27·18	8·30	95	—	,,	250–170	—	**2350**		
		40	0·13	33·88	27·21	8·20	96	—	**N 100 H**	0–5	**0008**	**0041**	1	
		50	0·00	33·88	27·22	8·15	92	—	,,	90	,,	,,	1	
		60	− 0·12	33·89	27·24	8·15	94	—	,,	180	,,	,,	1	KT
		80	− 0·34	33·93	27·28	8·10	98	—	**N 70 H**	0–5	**0116**	**0126**	¼	
		100	− 0·22	33·96	27·30	8·10	111	—	,,	62	,,	,,	¼	
		150	0·20	34·14	27·43	8·05	114	—	,,	124	,,	,,	¼	KT
		200	0·45	34·16	27·42	8·00	114							
		300	1·42	34·38	27·54	7·95	120							
		400	1·74	34·45	27·57	7·95	123							
		600	1·99	34·61	27·69	7·95	115							
		800	1·90	34·70	27·77	7·95	123							
40	19	120	− 0·24	33·91	27·26	—	—	—	**OTL** **N 7–T** **N 4–T** **NCS–T**	122–136	1448	1635	—	net badly torn
141	24	0	3·10	—	—	—	—	—	**BTS** **NCS–T**	17–27	1453	1545	—	two short hauls on steeply shelving ground at edge of kelp
142	25	80	0·45	33·82	27·15	—	—	—	**OTL** **N 7–T** **N 4–T** **NCS–T**	88–273	1317	1352	3·5	
143	25	—	—	—	—	—	—	—	**OTL** **N 7–T** **N 4–T** **NCS–T**	273	1525	1535		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
144	Off mouth of Stromness Hr, S Georgia. From 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W	5 i	1200	—	NW	4	NW	4	b. c.	990·6	2·8	mod. SE swell
			1255	155 gn. m. s.								
			1450	178								
			1600	gn. m. s.	NE	4	NE	4–5	b. c.	993·4	2·8	heavy SE swell
145	Stromness Hr, S Georgia. Between Grass I and Tonsberg Pt	7 i	1200	—	—	1	—	0	o. m. s.	998·6	5·5	
			1454	26								
			1530	35								
			1600	—	—	1	—	0	o. s.	998·6	1·7	
146	53° 48′ 00″ S, 35° 37′ 30″ W	8 i	1200	—	ESE	3	ESE	3	b. c.	1009·1	1·7	
			1345	728 r.								
			1600	—	SE	3	—	1	b. c.	1010·3	4·4	
147	53° 38′ 30″ S, 36° 02′ 00″ W	9 i	0800	—	WNW	2	WNW	2	b. c.	1010·2	4·4	
			0945	126 m.								
			1200	—	—	1	—	1	b. c.	1016·5	1·7	
148	Off C Saunders, S Georgia. From 54° 03′ S, 36° 39′ W to 54° 05′ S, 36° 36′ 30″ W	9 i	1600	—	WNW	6	WNW	5	b.	1017·1	3·9	
			1745	148 gy. m. st.								
			1855	132								
			2000	gy. m. st.	WNW	3	WNW	2	b.	1016·8	3·3	
149	Mouth of E Cumberland Bay, S Georgia. From 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock	10 i	0800	—	WNW	4	WNW	4	b. c.	1015·0	3·9	
			1037	200 m.								
			1200	234 m.	WNW	7	WNW	4	b. c.	1011·5	4·4	
150	From 53° 52′ 30″ S, 36° 00′ W to 53° 31′ S, 35° 24′ 30″ W	15–16 i	1600	—	NNW	4	NNW	4	o. f.	1006·1	3·3	heavy NW swell
			2000	—	NNW	3	NNW	3	o. f.	1003·6	2·2	,,
			0000	—	NNW	5	NNW	4	o. f. w.	1000·4	2·2	,,
			0400	—	NNW	3	NNW	3	o. f.	998·8	2·2	mod. NW swell
			0800	—	NNW	5	NNW	3	o. f.	997·4	2·2	,,
151	53° 25′ 00″ S, 35° 15′ 00″ W	16 i	0915	3200 di. oz.								
			1200	—	WSW	3	WSW	3	b. c.	1000·4	2·8	
			1600	—	SW	5	SW	5	b. c.	1005·8	3·3	
152	53° 51′ 30″ S, 36° 18′ 30″ W	17 i	0800	—	W × S	6	W × S	5	c. q.	1008·1	2·2	heavy W swell
			1100	245 r.								
			1200	—	W × N	4	W × N	3	b. c.	1006·7	2·9	slight W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
44	3	0	2·00	33·82	27·05	—	—	—	**OTL**					
		145	−0·15	33·98	27·32	—	—	—	**N 7–T**	155–178	1307	1407	4·0	cod-end, N 7–T and N 4–T torn
									N 4–T					
									NCS–T					
45	5	21	1·68	33·68	26·97	—	—	—	**BTS**	26–35	1454	1542	—	two short hauls on weedy ground
									NCS–T					
46	6	—	—	—	—	—	—	—	**DLH**	728	1358	1430		
47	7	0	1·35	33·82	27·10	—	109							
		5	1·00	33·80	27·10	—	110							
		10	0·85	33·81	27·12	—	116							
		20	0·84	33·81	27·12	—	118							
		30	0·84	33·81	27·12	—	118							
		40	0·80	33·81	27·12	—	118							
		50	0·75	33·83	27·13	—	118							
		60	0·72	33·83	27·14	—	118							
		80	0·60	33·83	27·14	—	118							
		100	0·25	34·04	27·33	—	128							
		115	0·25	34·05	27·34	—	132							
48	7	0	3·56	33·69	26·80	—	—	—	**OTL**					
		142	0·22	33·92	27·24	—	—	—	**N 4–T**	132–148	1755	1825	2·5	
									NCS–T					
49	8	0	3·00	33·68	26·85	—	—	—	**OTL**					
		190	0·25	34·13	27·40	—	—	—	**N 4–T**	200–234	1056	1158	3·0	
		0	4·10	33·22	26·39	—	—	—	**NCS–T**					
		230	−0·05	34·04	27·35									
50	13	—	—	—	—		—	—	**N 70 H**	0–5	1700	1715	0·6	50 consecutive hauls (A–AAA) of 15 mins. duration. A halt of 15 mins. between NN and OO. Sample OO lost. Sunset 2026; sunrise 0355
									,,	,,	0545	0600	0·6	
51	14	0	1·31	33·84	27·11	8·30	113	—	**N 50 V**	100–0	0915	—	—	TD 20 m.
		10	1·20	33·84	27·12	8·30	113	—	**N 70 V**	50–0				
		20	0·92	33·84	27·13	8·30	114	—	,,	100–50				
		30	0·81	33·82	27·13	8·30	110	—	,,	250–100				
		40	0·76	33·82	27·14	8·30	110	—	,,	500–250				
		50	0·60	33·84	27·15	8·24	109	—	,,	750–500				
		60	0·48	33·84	27·16	8·20	108	—	,,	1000–750	—	1155		
		80	0·26	33·87	27·20	8·20	106	—	**N 100 H**	0–5	1236	1314	1	
		100	−0·50	33·98	27·34	8·20	119	—	,,	56	,,	1312	1	
		150	−0·20	34·11	27·42	8·20	125	—	,,	112	,,	1313	1	KT
		200	0·85	34·30	27·51	8·15	139	—	**N 70 H**	0–5	1329	1340	¼	
		300	1·60	34·34	27·50	8·15	136	—	,,	66	,,	,,	¼	
		400	1·80	34·56	27·65	8·10	137	—	,,	132	,,	,,	¼	KT
		600	1·87	34·64	27·71	8·05	125	—	**N 450**	1025–1275	1512	1712	3·1	DGB
		800	1·73	34·67	27·75	8·00	125	—	**N 100 H**	500–625	1512	1705	3·1	
		1000	1·52	34·70	27·79	8·00	128							
		1500	1·07	34·70	27·83	7·96	125							
		2000	0·64	34·65	27·80	7·96	125							
		3000	0·30	34·65	27·82	7·96	130							
52	15	235	0·68	34·20	27·44	—	—	—	**DLH**	245	1114	1125		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
153	54° 08′ 30″ S, 36° 27′ 30″ W	17 i	1600	—	W × N	3	W × N	2	o.	1002·3	3·3	slight W swell
			1700	106 r.								
154	Jason Hr to Larsen Pt, S Georgia. From 2·6 miles S 84° W to 5½ cables S 26° E of Larsen Pt	18 i	0800	—	—	1	—	0	o. r. m.	991·2	3·3	
			1055	60 m.								
			1200	—	—	1	—	0	o. r. m.	984·3	3·3	slight W swell
			1205	160 m.								
155	4·1 miles S 26½° E of Larsen Pt, S Georgia	18 i	1430	260 m.								
			1600	—	SE	5	SE	2	o. f. d.	980·4	2·2	slight W swell
156	53° 51′ 00″ S, 36° 21′ 30″ W	20 i	1500	236 r.								
			1540	200 r.								
			1600	—	SSE	3	SE	3	o.	997·5	2·2	mod. SE swell
157	53° 51′ 00″ S, 36° 11′ 15″ W	20 i	1905	970								
			2000	di. oz. st. f. s.	SSE	3	SE	2	o.	997·2	1·7	mod. SE swell
158	53° 48′ 30″ S, 35° 57′ 00″ W	21 i	0800	—	ESE	3	ESE	3	o.	995·2	2·8	slight SE swell
			0840	401 r.								
			0955	411 r.								
159	53° 52′ 30″ S, 36° 08′ 00″ W	21 i	1200	160 r.	ESE	4	ESE	3	o.	994·6	2·2	
160	Near Shag Rocks, 53° 43′ 40″ S, 40° 57′ 00″ W	7 ii	1200	—	E	4	E	3	o. d.	992·1	2·2	mod. SW swell
			1320	177 gy. m. st. r.								
			1600	—	SSW	2	—	1	b. c.	994·4	3·9	,,
161	57° 21′ 20″ S, 46° 43′ 30″ W	14 ii	0800	—	W	4	W	2	o.	999·5	2·2	
			0905	3459 r.								
			1200	—	NNW	4	NW	2	o.	1001·5	2·2	
162	Off Signy I, S Orkneys, 60° 48′ 00″ S, 46° 08′ 00″ W	17 ii	1143	320								
			1200	gn. m.	—	1	—	0–1	o. m. s.	968·0	0·0	
163	Paul Harbour, Signy I, S Orkneys	17 ii	1535	18								
			1600	27	NE	2–3	—	0–1	c. g.	963·8	2·2	
164	E end of Normanna Strait, S Orkneys, near C Hansen, Coronation I	18 ii	1130	24								
			1200	-	—	1	—	0	o. m.	968·6	3·3	
			1215	36								
165	Dove Strait, SE of Queen's Bay, Signy I, S Orkneys	18–20 ii										

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
53	15	100	0·22	33·91	27·24	—	—	—	**DLH**	106	1707	1717		
54	16	55	0·55	33·80	27·13	—	—	—	**OTL** **N 7–T** **N 4–T** **NCS–T**	60–160	1110	1140	2·8	
55	16	—	—	—	—	—	—	—	**OTL** **N 7–T** **N 4–T** **NCS–T**	260	1445	1450	—	trawl hitched; greater part of net lost
56	18	—	—	—	—	—	—	—	**DLH**	200–236	1511	1521		
									,,	200–236	1545	1555		
57	18	—	—	—	—	—	—	—	**DLH**	970	1922	1935	—	stop parted; bag torn
58	19	—	—	—	—	—	—	—	**DLH**	401	0852	0902		
									,,	411	1004	1018		
59	19	—	—	—	—	—	—	—	**DLH**	160	1216	1220		
60	7	0	3·00	33·77	26·92	8·28	—	—	**N 50 V**	100–0	1320	—	—	TD 17 m.
		10	2·90	33·77	26·93	8·28	—	—	**N 70 V**	50–0				
		20	2·88	33·77	26·93	8·28	—	—	,,	100–50				
		30	2·87	33·76	26·93	8·28	—	—	,,	180–100	—	1350		
		40	2·88	33·75	26·92	8·28	—	—	**DLH**	177	1438	1442		
		50	2·80	33·80	26·95	8·20	—	—	**N 100 H**	0–5	1515	1543	1	
		60	1·81	33·86	27·08	8·13	—	—	,,	40	,,	,,	1	
		80	0·82	33·91	27·20	8·05	—	—	,,	80(–0)	,,	,,	1	KT
		100	0·70	34·04	27·31	7·98	—	—	**N 70 H**	0–5	1602	1613	¼	
		135	0·82	34·09	27·34	7·98	—	—	,,	42	,,	1611	¼	
		170	1·42	34·22	27·40	7·98	—	—	,,	84	,,	1612	¼	KT
161	13	0	1·45	33·58	26·90	8·16	—	—	**N 50 V**	100–0	0905	—	—	TD 13 m.
		10	1·44	33·80	27·07	8·16	—	—	**N 70 V**	50–0				
		20	1·43	33·80	27·07	8·16	—	—	,,	100–50				
		30	1·48	33·82	27·09	8·16	—	—	,,	250–100				
		40	1·45	33·82	27·09	8·16	—	—	,,	500–250				
		50	1·35	33·82	27·10	8·16	—	—	,,	750–500				
		60	1·32	33·83	27·10	8·16	—	—	,,	1000–750	—	1100		
		80	0·42	33·91	27·23	8·16	—	—	**N 100 H**	0–5	1158	1219	1	
		100	–0·10	34·09	27·40	8·11	—	—	,,	38	,,	,,	1	
		150	–0·08	34·18	27·47	8·11	—	—	,,	79(–0)	,,	,,	1	KT
		200	0·85	34·29	27·50	8·05	—	—	**N 70 H**	0–5	1235	1243	¼	
		300	1·94	34·61	27·69	7·98	—	—	,,	40	,,	,,	¼	
		400	1·82	34·69	27·75	7·98	—	—	,,	80	,,	,,	¼	
		600	1·74	34·70	27·78	7·98								
		800	1·57	34·70	27·79	7·95								
		1000	1·34	34·72	27·82	8·00								
		1500	0·91	34·72	27·85	8·00								
		2000	0·54	34·71	27·86	8·00								
		3000	0·09	34·67	27·86	8·02								
162	16	0	–0·80	33·21	26·71	—	—	—	**DLH**	320	1150	1154		
		310	–0·38	34·56	27·79									
163	16	—	—	—	—	—	—	—	**BTS** **NCS–T**	18–27	1535	1540		
164	17	0	–0·31	33·53	26·96	—	—	—	**BTS** **NCS–T**	24–36	1145	1200		
		18	0·76	33·66	26·99	—	—	—						
165	17	—	—	—	—	—	—	—	**TNL**	10				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
166	SE point of Paul Hr, Signy I, S Orkneys	19 ii	1200	—	SSW	2	—	0	o. m.	989·8	1·7	
			1600	—	—	0–1	—	0	o. m.	991·4	2·2	
167	Off Signy I, S Orkneys, 60° 50′ 30″ S, 46° 15′ 00″ W	20 ii	0800	—	SE	2	—	0	o.	998·1	2·2	192 icebergs in sight
			1045	344 gn. m.								
			1200	—	NW	3	NW	1	c.	995·0	1·1	
			1255	244 gn. m.								
168	60° 58′ 00″ S, 48° 05′ 00″ W	21 ii	1200	—	SW	6	SW	5	o.	989·0	0·0	
169	60° 48′ 50″ S, 51° 00′ 20″ W	22 ii	0800	—	SSW	2	—	0	b. v.	994·1	0·0	alongside tabular berg, 35 miles in length
			0905	2514 di. oz.								
			1200	—	SSW	2	—	0	b. v.	996·3	1·1	
			1530	1849 r.								
			1600	—	W × S	2	—	0	b. v.	997·9	1·7	
170	Off C Bowles, Clarence I, 61° 25′ 30″ S, 53° 46′ 00″ W	23 ii	1600	—	NE	5	NE	5	c.	992·6	1·1	
			1635	342 r.								
171	16 miles off C Melville, King George I, S Shetlands, 62° 07′ 00″ S, 57° 03′ 00″ W	25 ii	0800	—	ENE	3	ENE	2	o. s. g.	986·5	1·1	
			0905	1542 di. oz.								
			1200	—	ENE	3	ENE	2	o. s. m.	987·4	1·1	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
66	18	—	—	—	—	—	—	—	**Sh. coll.**	0–1	1500			
67	19	0	− 0·67	33·18	26·69	8·26	—	—	**N 50 V**	100–0	1045			
		10	− 0·68	33·31	26·80	8·26	—	—	**N 70 V**	50–0				
		20	− 0·58	33·48	26·92	8·26	—	—	,,	100–50				
		30	− 0·60	33·62	27·05	8·20	—	—	,,	250–100				
		40	− 0·52	33·82	27·21	8·20	—	—	,,	340–0	—	1130		
		50	− 0·60	33·96	27·31	8·20	—	—	**OTL**					
		60	− 0·56	33·98	27·34	8·20	—	—	**N 7–T**	244–344	1210	1230	—	trawl hitched; net torn
		80	0·50	34·11	27·43	8·20	—	—	**N 4–T**					
		100	0·68	34·13	27·45	8·15	—	—	**NCS–T**					
		150	1·01	34·33	27·62	8·10								
		200	1·10	34·42	27·69	8·03								
		240	0·50	34·54	27·78	8·03								
68	20	0	− 0·20	33·66	27·05	—	—	—	**N 100 H**	0–5	1146	1223	1	
									,,	78	,,	,,	1	
									,,	157	,,	,,	1	KT
									N 70 H	0–5	1239	1252	¼	
									,,	77	,,	,,	¼	
									,,	154	,,	,,	¼	KT
69	21	0	− 0·42	34·16	27·47	8·22	—	—	**N 50 V**	100–0	0905	—	—	TD 19 m.
		10	− 0·47	34·16	27·47	8·22	—	—	**N 70 V**	50–0				
		20	− 0·48	34·19	27·49	8·22	—	—	,,	100–50				
		30	− 0·50	34·20	27·50	8·22	—	—	,,	250–100				
		40	− 0·56	34·24	27·54	8·22	—	—	,,	500–250				
		50	− 0·58	34·25	27·55	8·22	—	—	,,	750–500				
		60	− 0·60	34·31	27·60	8·16	—	—	,,	1000–750				
		80	− 0·62	34·33	27·61	8·16	—	—	,,	2500–1500	—	1210		
		100	− 0·72	34·34	27·64	8·16	—	—	**TYF**	1000–1100	1238	1350	0·8	
		150	− 0·82	34·37	27·66	8·10								
		200	− 0·80	34·42	27·69	8·10								
		300	− 0·86	34·43	27·71	8·08								
		400	− 0·78	34·51	27·77	8·05								
		600	− 0·31	34·63	27·85	8·01								
		800	− 0·18	34·65	27·85	8·01								
		1000	− 0·10	34·65	27·84	8·03								
		1700	− 0·25	34·63	27·84	8·03								
		2400	− 0·68	34·63	27·86	8·06								
70	21	0	0·65	33·91	27·21	—	—	—	**DLH**	342	1650	1655		
		335	− 0·42	34·47	27·72									
71	23	0	0·62	33·90	27·20	8·20	—	—	**N 50 V**	100–0	0905	—	—	TD 12½ m.
		10	0·60	33·91	27·21	8·20	—	—	**N 70 V**	50–0				
		20	0·60	33·92	27·21	8·20	—	—	,,	100–50				
		30	0·60	33·95	27·24	8·20	—	—	,,	250–100				
		40	0·60	33·91	27·21	8·20	—	—	,,	500–250				
		50	0·55	33·94	27·24	8·20	—	—	,,	750–500				
		60	0·45	33·95	27·25	8·16	—	—	,,	1000–750	—	1100		
		80	0·38	34·00	27·30	8·11	—	—	**N 100 H**	0–5	1119	1152	1	
		100	0·25	34·00	27·31	8·08	—	—	,,	64	,,	,,	1	
		150	− 0·12	34·25	27·53	8·03	—	—	,,	128	,,	,,	1	KT
		200	0·00	34·40	27·64	8·03	—	—	**N 70 H**	0–5	1225	1232	¼	
		300	− 0·60	34·47	27·73	8·03	—	—	,,	64	1207	1219	¼	
		400	− 0·55	34·51	27·76	8·03	—	—	,,	128	,,	,,	¼	
		600	− 0·94	34·52	27·79	8·03								
		800	− 1·03	34·54	27·81	8·03								
		1000	− 1·34	34·58	27·85	8·03								
		1500	− 1·68	34·61	27·89	8·03								

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
172	Off Deception I, S Shetlands, 62° 59′ 00″ S, 60° 28′ 00″ W	26 ii	1200	—	NNW	5	NNW	3	o.	981·5	2·8	
			1245	525 r.								
173	Port Foster, Deception I, S Shetlands. Close to SE shore, near Lake Point	28 ii	1200	—	SW	3	—	o	o.	987·8	1·7	
			1445	5								
			1525	60								
			1600	—	SW	4	—	o	o.	986·6	1·7	
174	Deception I, S Shetlands. Outside entrance, W of Lt	28 ii–2 iii										
175	Bransfield Strait, S Shetlands, 63° 17′ 20″ S, 59° 48′ 15″ W	2 iii	2000	—	E	3	E	2	c.	997·3	1·7	
			2010	200 m. st. g.								
176	12 miles SW of Deception I, S Shetlands, 63° 09′ 30″ S, 60° 46′ 00″ W	5 iii	0800	—	NW	4	NW	2	o. f.	984·0	1·7	mod. SSW swell
			1200	—	—	o	—	1	o. f.	981·8	1·1	,,
177	27 miles SW of Deception I, S Shetlands, 63° 17′ 30″ S, 61° 17′ 00″ W	5 iii	1600	—	WNW	7	WNW	6	o. r. g.	979·3	0·5	
			1852	1080 m. cs. st.								
			2000	—	SW	6	SW	5	b. c.	984·3	1·7	
178	Melchior Hr, Schollaert Channel, Palmer Archipelago	9–11 iii										
179	Melchior I, Schollaert Channel, Palmer Archipelago. In creek to S of SW anchorage	10 iii	1200	—	—	1	—	o	o. s. m.	990·9	−1·1	
			1430	4 r.								
			1530	10 r.								
			1600	—	—	1	—	o	o. s. m.	989·3	−0·6	
180	1·7 miles W of N point of Gand I, Schollaert Channel, Palmer Archipelago	11 iii	0800	—	—	1	—	o	o. s. m.	983·6	0·0	
			0944	160 m. st.								
			1200	330 m. st.	—	1	—	o	o. s. m.	980·8	1·1	
			1600	—	—	1	—	o	o. m.	981·8	1·1	
181	Schollaert Channel, Palmer Archipelago, 64° 20′ 00″ S, 63° 01′ 00″ W	12 iii	0800	—	—	1	—	o	o. s.	980·9	−0·6	
			1005	160 m.								
			1200	—	—	1	—	o	c. s. m.	981·3	0·0	
			1210	335 m.								
182	Schollaert Channel, Palmer Archipelago, 64° 21′ 00″ S, 62° 58′ 00″ W	14 iii	1200	—	SW	3	—	o	b. c.	983·7	2·8	
			1452	278 m.								
			1600	—	SW	3	—	o	b. c.	985·4	2·2	
			1605	500 m.								
183	Schollaert Channel, Palmer Archipelago, 64° 21′ 30″ S, 63° 00′ 00″ W	14 iii	2000	—	—	1	—	o	b. c.	988·0	1·7	
184	Fournier Bay, Anvers I, Palmer Archipelago, 64° 30′ 00″ S, 62° 54′ 00″ W	15–16 iii										

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	*σt*	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
2	24	0 500	0·75 0·25	33·77 34·60	27·09 27·79	—	—	—	**DLH**	525	1300	1306	—	stop parted
3	26	5 60	1·01 0·85	33·73 33·76	27·04 27·07	—	—	—	**BTS** **NCS–T**	5–60	1445	1525		three short hauls on steeply shelving ground
4	26–28	—	—	—	—	—	—	—	**TNL** **TGS**	5–10				
5	28	0 190	0·35 − 0·48	34·04 34·34	27·32 27·62	—	—	—	**DLH**	200	**2018**	**2025**		
6	3	—	—	—	—	—	—	—	**N 100 H**	0–5	0948	1023	1	net slightly torn
									,,	89	,,	1021	1	
									,,	178	,,	1022	1	KT
									N 70 H	0–5	1037	1050	¼	
									,,	87	,,	,,	¼	
									,,	175	,,	,,	¼	KT
7	3	0	0·35	33·82	27·16	—	—	—	**NH**	0	1830			
									DLH	1080	**1908**	**1914**		
8	7	—	—	—	—	—	—	—	**TNL**	17				
9	9	—	—	—	—	—	—	—	**DS**	4–10	1430	1530	—	three short hauls
									N 70 H	0–1	1500	1510		
									Sh. coll.					
30	9	0	− 0·02	33·26	26·72	—	—	—	**DLH**	160	1001	1007		
		150	0·00	34·16	27·45	—	—	—	**OTL** **N 7–T** **N 4–T** **NCS–T**	160–330	1304	1334		
									N 100 H	0–5	1436	1500	1	
									,,	55	,,	1458	1	
									,,	110	,,	1459	1	KT
									N 70 H	0–5	1514	1524	¼	
									,,	43	,,	,,	¼	
									,,	86	,,	,,	¼	KT
31	10	0	− 0·05	33·10	26·59	—	—	—	**OTL**					
		325	0·40	34·51	27·71	—	—	—	**N 7–T** **N 4–T** **NCS–T**	160–335	1035	1048		
32	12	0	− 0·21	32·94	26·47	—	—	—	**OTL**					
		250	0·12	34·44	27·66	—	—	—	**N 7–T** **N 4–T** **NCS–T**	278–500	1512	1532		
33	12	—	—	—	—	—	—	—	**N 100 H**	0–5	1716	1747	1	
									,,	68	,,	,,	1	
									,,	137	,,	,,	1	KT
									N 70 H	0–5	1803	1812	¼	
									,,	69	,,	,,	¼	
									,,	140	,,	,,	¼	KT
34	13	—	—	—	—	—	—	—	**TNL**	36				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
185	Gerlache Strait, Palmer Archipelago,	16 iii	1100	598 di. oz.								
	3·5 miles S 119° E of C van Wycks, Anvers I		1200	—	NE	3	—	0	o. m.	999·1	0·6	
186	Fournier Bay, Anvers I, Palmer Archipelago,	16 iii	1600	—	SE	5	—	0	o.	996·1	0·6	
	64° 25′ 30″ S, 63° 02′ 00″ W		1700	295 m.								
187	Neumayr Channel, Palmer Archipelago,	18 iii	0800	—	—	0	—	0	b. c.	988·6	0·6	
			0945	200 gy. m.								
	64° 48′ 30″ S, 63° 31′ 30″ W		1200	—	—	0	—	0	b. c. s.	991·1	0·6	
			1218	354 m.								
			1325	259 m.								
			1600	—	—	0–1	—	0	b. c.	996·7	0·6	
188	SW of Bismarck Strait, Palmer Archipelago,	19 iii	1600	—	ENE	6	ENE	5	o. s.	998·4	1·1	v. heavy swell
			2000	—	ENE	6	ENE	5	b. c.	995·1	0·6	,,
	64° 58′ 00″ S, 65° 11′ 00″ W											
189	Port Lockroy, Wiencke I, Palmer Archipelago	22 iii	1200	—	NE	6	—	0	o. s.	968·0	0·6	
		23 iii	1600	—	NE	3	—	0	b. c.	976·7	1·1	
			2000	—	NE	3	—	0	b. c.	977·2	1·1	
			0000	—	—	0	—	0	b. c.	980·4	0·6	
		25 iii	0400	—	—	1	—	0	b. c.	996·3	0·6	
			0600	—	—	0	—	0	—	—	5·0	
			0800	—	—	1	—	0	b. c.	998·3	0·6	
190	Bismarck Strait, Palmer Archipelago,	24 iii	1140	308 r.								
			1200	—	—	0	—	0	b. c.	983·5	1·1	
	64° 56′ 00″ S, 65° 35′ 00″ W		1415	315 m. r.								
			1541	93 r.								
			1600	126 st. m. r.	—	0–1	—	0	b. c.	987·5	1·1	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth metres	Temp. ° Cent.	S °/₀₀	*at*	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
35	14	0	−0·34	33·36	26·81	8·16			**N 50 V**	100–0	1100			
		10	−0·34	33·37	26·82	8·16			**N 70 V**	50–0				
		20	−0·34	33·47	26·90	8·16			,,	100–50				
		30	−0·28	33·55	26·97	8·16			,,	250–100				
		40	−0·30	33·58	27·00	8·16			,,	500–250	—	1201		
		50	−0·30	33·60	27·02	8·16			**N 100 H**	0–5	1240	1336	1	
		60	−0·30	33·63	27·04	8·08			,,	95	,,	,,	1	
		80	−0·28	33·69	27·08	8·08			,,	190	,,	,,	1	KT
		100	−0·20	33·86	27·21	8·01			**N 70 H**	0–5	1349	1357	¼	
		150	0·10	34·25	27·51	7·96			,,	74	,,	,,	¼	
		200	0·20	34·38	27·62	7·96			,,	148	,,	,,	¼	KT
		300	−0·10	34·43	27·68	7·93								
		400	−0·12	34·47	27·71	7·93								
		540	−0·20	34·51	27·74	7·95								
36	14	—	—	—	—	—	—	—	**DLH**	295	1718	1729		
37	16	0	−0·05	33·42	26·86	8·16	—	—	**N 50 V**	100–0	0945	—	—	TD 14 m.
		10	−0·10	33·49	26·91	8·16	—	—	**N 70 V**	50–0				
		20	−0·05	33·49	26·91	8·14	—	—	,,	100–50				
		30	0·00	33·51	26·93	8·14	—	—	,,	195–100	—	1020		
		40	0·00	33·51	26·93	8·12	—	—	**N 100 H**	0–5	1039	1107	1	
		50	−0·05	33·54	26·95	8·08	—	—	,,	76	,,	,,	1	
		60	−0·02	33·60	27·00	8·07	—	—	,,	152	,,	,,	1	KT
		80	0·00	33·69	27·07	8·00	—	—	**N 70 H**	0–5	1120	1131	¼	
		100	−0·05	33·78	27·15	7·97	—	—	,,	88	,,	,,	¼	
		150	0·00	33·93	27·26	7·96	—	—	,,	177	,,	,,	¼	KT
		190	0·18	34·23	27·50	7·96	—	—	**OTL**					
									N 7–T					
									N 4–T	259–354	1235	1251	—	trawl hitched; net mainly lost
									NCS–T					
									DLH	259	1416	1421	—	stop parted
38	16	—	—	—	—	—	—	—	**N 100 H**	0–5	1629	1707	1	
									,,	81	,,	1705	1	
									,,	162	,,	1706	1	KT
									N 70 H	0–5	1721	1732	¼	
									,,	81	,,	,,	¼	
									,,	162	,,	,,	¼	KT
39	18–22	0	−0·92	33·38	26·86				**TNL**	7	—	—	—	21–23 iii
		10	−0·20	33·40	26·85	—	—	—	**NH**	0	1600	—	—	22 iii
		20	0·10	33·54	26·95	—	—	—	**Sh. coll.**	—	—	—	—	22 iii
		28	−0·10	33·57	26·97	—	—	—	**N 70 H**	2	1730	**2030**	—	A) 23 iii. Streamed
									N 70 H	2	**2040**	**2355**	—	B) from anchored ship
									TNL	70	—	—	—	23–25 iii
40	21	0	−0·32	33·30	26·76	8·14			**N 50 V**	100–0	1140			TD 20 m.
		10	−0·32	33·37	26·82	8·14			**N 70 V**	50–0				
		20	0·30	33·37	26·82	8·14			,,	100–0				
		30	−0·35	33·37	26·82	8·12			,,	250–100	—	1220		
		40	−0·32	33·42	26·87	8·12			**N 100 H**	0–5	1241	1318	1	
		50	0·33	33·51	26·94	8·07			,,	65	,,	,,	1	
		60	−0·32	33·53	26·95	8·07			,,	130	,,	,,	1	KT. Net touched bottom
		80	0·33	33·69	27·09	8·03			**N 70 H**	0 5	1338	1351	¼	
		100	−0·31	33·89	27·25	8·03			,,	56	,,	,,	¼	
		150	0·20	34·27	27·53	7·97			,,	113	,,	,,	¼	KT
		200	0·38	34·40	27·62	7·96			**DLH**	315	1422	1427		
		300	0·55	34·49	27·68	7·93			,,	93–126	1544	1547		
									NRL	126	1622	1627		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
191	Gerlache Strait, Palmer Archipelago, 2·5 miles N 114° E of C Astrup, Wiencke I	25 iii	0800	—	—	1	—	0	b. c.	998·3	−0·6	
			1050	310 m. di. oz.								
			1200	—	—	0	—	0	b. c.	1000·9	0·6	
192	Off C Kaiser, Brabant I, Palmer Archipelago, 64° 14′ 00″ S, 61° 49′ 00″ W	27 iii	1200	—	—	1	—	1	c.	1004·8	−0·6	
			1440	800 di. oz.								
			1600	—	—	1	—	1	c.	1006·2	0·6	
193	17½ miles N of Hoseason I, Palmer Archipelago, 63° 24′ 00″ S, 61° 33′ 00″ W	28 iii	1100	1021 r.								
			1200	—	NE	3	NE	2	b. c.	1008·5	0·0	
			1600	—	NE	2	—	1	b.	1008·3	0·6	
194	2½ miles E of Deception I, S Shetlands, 62° 57′ 30″ S, 60° 22′ 00″ W	28 iii	2000	—		1		1	b. v.	1008·7	0·6	
			2100	812 di. oz.								
			0000	—	NW	2	NW	2	o.	1009·0	0·0	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
91	22	0	− 0·30	33·40	26·85	8·16	—	—	**N 50 V**	100–0	1050	—	—	TD 18½ m.
		10	− 0·31	33·43	26·87	8·14	—	—	**N 70 V**	50–0				
		20	− 0·30	33·46	26·89	8·14	—	—	,,	100–50				
		30	− 0·24	33·51	26·94	8·14	—	—	,,	250–100	—	1130		
		40	− 0·20	33·55	26·97	8·12	—	—	**N 100 H**	0–5	1152	1226	1	
		50	− 0·18	33·66	27·05	8·08	—	—	,,	62	,,	,,	1	
		60	− 0·18	33·66	27·05	8·08	—	—	,,	124	,,	,,	1	KT
		80	− 0·18	33·66	27·05	8·08	—	—	**N 70 H**	0–5	1239	1247	¼	
		100	− 0·18	33·67	27·06	8·08	—	—	,,	66	,,	,,	¼	
		150	0·26	34·33	27·56	7·96	—	—	,,	132	,,	,,	¼	KT
		200	0·28	34·42	27·63	7·96								
		300	− 0·11	34·50	27·73	7·96								
92	23	0	− 0·15	33·46	26·89	8·16	—	—	**N 50 V**	100–0	1440	—	—	TD 22 m.
		10	− 0·32	33·48	26·91	8·14	—	—	**N 70 V**	50–0				
		20	− 0·33	33·48	26·91	8·14	—	—	,,	100–50				
		30	− 0·31	33·53	26·95	8·10	—	—	,,	250–100				
		40	− 0·30	33·56	26·97	8·10	—	—	,,	500–250				
		50	− 0·30	33·60	27·02	8·10	—	—	,,	750–500	—	1530		
		60	− 0·29	33·60	27·02	8·09	—	—	**N 100 H**	0–5	1605	1634	1	
		80	− 0·22	33·71	27·10	8·02	—	—	,,	53	,,	,,	1	
		100	− 0·21	33·86	27·21	8·00	—	—	,,	106	,,	,,	1	KT
		150	0·00	34·22	27·49	7·98	—	—	**N 70 H**	0–5	1648	1657	¼	
		200	0·00	34·38	27·63	7·95	—	—	,,	61	,,	,,	¼	
		300	0·02	34·51	27·73	7·95	—	—	,,	122	,,	,,	¼	KT
		400	− 0·06	34·54	27·76	7·95								
		600	− 0·28	34·56	27·78	7·95								
		780	− 0·49	34·58	27·81	7·96								
93	24	0	0·00	33·77	27·13	8·16	—	—	**N 50 V**	100–0	1100	—	—	TD 25 m.
		10	0·00	33·80	27·16	8·16	—	—	**N 70 V**	50–0				
		20	− 0·08	33·86	27·20	8·14	—	—	,,	100–50				
		30	− 0·10	33·95	27·29	8·09	—	—	,,	250–100				
		40	− 0·11	34·02	27·35	8·09	—	—	,,	500–250				
		50	− 0·15	34·10	27·41	8·07	—	—	,,	750–500				
		60	− 0·17	34·14	27·45	8·07	—	—	,,	1000–750	—	1240		
		80	− 0·20	34·27	27·55	8·04	—	—	**N 100 H**	0–5	1253	1326	1	
		100	− 0·36	34·31	27·59	8·04	—	—	,,	73	,,	,,	1	
		150	− 0·45	34·33	27·60	8·00	—	—	,,	146	,,	,,	1	KT
		200	− 0·58	34·37	27·65	8·00	—	—	**N 70 H**	0–5	1345	1357	¼	
		300	− 0·66	34·44	27·70	7·98	—	—	,,	75	,,	,,	¼	
		400	− 0·26	34·51	27·74	7·96	—	—	,,	150	,,	,,	¼	KT
		600	− 0·28	34·54	27·77	7·95								
		800	− 0·40	34·54	27·78	7·97								
		950	− 0·63	34·56	27·80	7·98								
94	24	0	0·41	33·78	27·13	8·14	—	—	**N 50 V**	100–0	**2100**			
		10	0·41	33·80	27·14	8·14	—	—	**N 70 V**	50–0				
		20	0·38	33·84	27·17	8·11	—	—	,,	100–50				
		30	0·21	33·95	27·27	8·10	—	—	,,	250–100				
		40	0·17	33·95	27·27	8·09	—	—	,,	500–250				
		50	0·13	33·95	27·27	8·04	—	—	,,	750–500	—	**2220**		
		60	0·11	33·97	27·29	8·04	—	—	**N 100 H**	0–5	**2253**	**2331**	1	
		80	0·00	34·07	27·38	8·02	—	—	,,	73	,,	,,	1	
		100	− 0·04	34·22	27·49	7·99	—	—	,,	146	,,	,,	1	KT
		150	0·00	34·33	27·58	7·99	—	—	**N 70 H**	0–5	**2350**	**2359**	¼	
		200	− 0·22	34·38	27·64	7·97	—	—	,,	70	,,	,,	¼	
		300	0·32	34·53	27·77	7·96	—	—	,,	140	,,	,,	¼	
		400	0·19	34·58	27·78	7·96								
		600	0·90	34·54	27·81	7·97								
		780	1·06	34·54	27·81	8·00								

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. °C. Cent.	Remarks
					Direction	Force	Direction	Force				
195	Admiralty Bay, King George I, S Shetlands, 62° 07′ 00″ S, 58° 28′ 30″ W	1927 30 iii	0800	—	SW	3	—	0	b. c.	1007·3	−0·6	
			1000	391 m. st.								
			1200	—	SW	6	—	0	o. m. s.	1004·0	0·6	
196	Bransfield Strait, S Shetlands, 62° 17′ 30″ S, 58° 21′ 00″ W	3 iv	0800	—	—	1	—	0	b. c.	996·4	−6·7	
			1055	1011 di. oz.								
			1200	—	SE	2	SE	3	b. c.	998·2	−5·6	slight SE swell
			1210	720 m. di. oz.								
197	Bransfield Strait, S Shetlands, 62° 27′ 00″ S, 58° 11′ 30″ W	3 iv	1600	—	SE	4	SE	3	b. c.	998·4	−6·1	slight SE swell
			1620	1974 di. oz.								
			2000	—	SE	4	SE	3	o.	1000·9	−6·7	,,
198	Bransfield Strait, S Shetlands, 62° 38′ 00″ S, 58° 04′ 00″ W	3–4 iv	2220	1600 di. oz.								
			0000	—	SE	4	SE	3	c.	1001·0	−7·2	slight SE swell
			0400	—	SE	4	SE	3	b. c.	997·3	−7·9	
199	Bransfield Strait, S Shetlands, 62° 49′ 00″ S, 57° 56′ 30″ W	4 iv	0800	—	ESE	5	ESE	4	c. v.	1002·2	−10·0	
			0900	735 di. oz.								
			1200	—	NE	5	NE	3	c. v.	1001·0	−8·9	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
195	26	0	0·32	33·86	27·18	—	—	—	**DLH**	391	1012	1018		
		380	0·04	34·36	27·61	—	—	—	**OTM** **N 7–T** **N 4–T** **NCS–T**	391	1230	—	—	trawl hitched as soon as shot
196	2	0	0·15	33·84	27·18	8·16	—	—	**N 50 V**	100–0	1055	—	—	TD 18 m.
		10	0·18	33·86	27·19	8·16	—	—	**N 70 V**	50–0				
		20	0·18	33·85	27·18	8·12	—	—	,,	100–50				
		30	0·20	33·94	27·26	8·10	—	—	,,	250–100				
		40	0·20	33·95	27·27	8·10	—	—	,,	500–250				
		50	0·10	34·05	27·35	8·09	—	—	,,	700–500				
		60	− 0·04	34·05	27·36	8·07	—	—	,,	720	—	1240	—	touched bottom
		80	− 0·02	34·05	27·36	8·05	—	—	**N 100 H**	0–5	1301	1331	1	
		100	0·04	34·11	27·41	8·00	—	—	,,	91	,,	,,	1	
		150	− 0·21	34·14	27·45	8·00	—	—	,,	182	,,	,,	1	KT
		200	0·00	34·38	27·63	7·96	—	—	**N 70 H**	0–5	1346	1402	¼	
		300	− 0·72	34·42	27·69	7·95	—	—	,,	91	,,	,,	¼	
		400	− 0·21	34·51	27·74	7·95	—	—	,,	182	,,	,,	¼	KT
		650	− 0·73	34·47	27·74	8·01								
197	2	0	0·08	33·98	27·31	8·16	—	—	**N 50 V**	100–0	1620			
		10	0·05	34·04	27·35	8·16	—	—	**N 70 V**	50–0				
		20	0·07	33·98	27·31	8·16	—	—	,,	100–50				
		30	0·10	33·98	27·30	8·16	—	—	,,	250–100				
		40	0·10	34·04	27·34	8·16	—	—	,,	500–250				
		50	0·09	34·04	27·34	8·15	—	—	,,	750–500				
		60	0·10	33·98	27·30	8·13	—	—	,,	1000–750	—	**1805**		
		80	− 0·10	34·09	27·40	8·08	—	—	**N 100 H**	0–5	**1836**	**1914**	1	
		100	− 0·46	34·23	27·53	8·02	—	—	,,	67	,,	,,	1	
		150	− 0·68	34·41	27·67	7·98	—	—	,,	134	,,	,,	1	KT
		200	− 0·71	34·41	27·68	7·98	—	—	**N 70 H**	0–5	**1932**	**1943**	¼	
		300	− 0·82	34·56	27·81	7·96	—	—	,,	62	,,	,,	¼	
		400	− 0·85	34·57	27·83	7·96	—	—	,,	124	,,	,,	¼	KT
		600	− 1·11	34·60	27·85	7·96								
		800	− 1·33	35·06?	28·23?	7·98								
		1000	− 1·53	34·63	27·90	8·00								
		1500	− 1·67	34·65	27·91	8·00								
		1900	− 1·70	34·60	27·87	8·00								
198	2	0	− 0·20	33·98	27·32	8·16	—	—	**N 50 V**	100–0	**2220**			
		10	− 0·22	33·95	27·29	8·15	—	—	**N 70 V**	50–0				
		20	− 0·18	33·95	27·29	8·15	—	—	,,	100–50				
		30	− 0·45	34·04	27·37	8·12	—	—	,,	250–100				
		40	− 0·56	34·12	27·44	8·09	—	—	,,	500–250				
		50	− 0·58	34·12	27·44	8·09	—	—	,,	750–500				
		60	− 0·58	34·18	27·50	8·09	—	—	,,	1000–750	—	**0042**		
		80	− 0·50	34·17	27·49	8·03	—	—	**N 100 H**	0–5	**0102**	**0143**	1	
		100	− 0·59	34·29	27·58	7·98	—	—	,,	76	,,	,,	1	KT
		150	− 0·68	34·34	27·63	7·98	—	—	**N 70 H**	0–5	**0201**	**0216**	¼	
		200	− 0·63	34·42	27·68	7·98	—	—	,,	68	,,	,,	¼	
		300	− 0·70	34·47	27·74	7·96	—	—	,,	137	,,	,,	¼	KT
		400	− 0·85	34·47	27·74	7·96								
		600	− 0·76	34·49	27·75	8·00								
		800	− 0·94	34·52	27·78	8·00								
		1000	− 1·13	34·49	27·76	8·00								
		1500	− 1·74	34·87	28·09	8·01								
199	3	0	− 0·75	34·10	27·44	8·12	—	—	**N 50 V**	100–0	0900	—	—	TD 23 m.
		10	− 0·78	34·12	27·45	8·12	—	—	**N 70 V**	50–0				
		20	− 0·79	34·22	27·53	8·12	—	—	,,	100–50				
		30	− 0·79	34·22	27·53	8·10	—	—	,,	250–100				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. °Cent.	Remarks
					Direction	Force	Direction	Force				
199 *cont.*	Bransfield Strait, S Shetlands, 62° 49′ 00″ S, 57° 56′ 30″ W	1927 4 iv										
200	Bransfield Strait, S Shetlands, 62° 59′ 30″ S, 57° 49′ 00″ W	4 iv	1455	345 m. di. oz.								
			1600	—	NNE	4	NNE	3	c. v.	999·4	−10·0	
201	Bransfield Strait, S Shetlands, 63° 00′ 30″ S, 59° 06′ 30″ W	5 iv	0800	—	WNW	5	WNW	3	o.	993·2	−5·0	
			0820	343 m. di. oz.								
			1200	—	SE	3	SE	3	b. c.	993·7	−6·1	
202	Bransfield Strait, S Shetlands, 62° 48′ 00″ S, 60° 05′ 00″ W	5 iv	1600	—	W	2	W	2	o.	994·9	−3·9	
			1720	909 di. oz.								
			2000	—	W	2	W	2	o. s.	992·8	−5·0	
203	Bransfield Strait, S Shetlands, 62° 56′ 00″ S, 59° 50′ 00″ W	5–6 iv	2240	949 di. oz.								
			0000	—	SW	2	SW	2	o. s. m.	993·4	−4·4	
			0400	—	W	3	W	3	c. s. g.	991·5	−1·7	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	*at*	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
99		40	− 0·80	34·18	27·51	8·10	—	—	**N 70 V**	500–250				
nt.		50	− 0·80	34·25	27·56	8·08	—	—	,,	700–500	—	1030		
		60	− 0·78	34·18	27·51	8·08	—	—	**N 100 H**	0–5	1126	1208	1	
		80	− 0·70	34·22	27·53	8·08	—	—	,,	72	,,	,,	1	
		100	− 0·75	34·33	27·62	8·06	—	—	,,	145	,,	,,	1	KT
		150	− 0·98	34·36	27·66	8·06	—	—	**N 70 H**	0–5	1224	1238	¼	
		200	− 1·00	34·42	27·70	8·02	—	—	,,	85	,,	,,	¼	
		300	− 1·11	34·42	27·70	8·00	—	—	,,	170	,,	,,	¼	KT
		400	− 1·14	34·57	27·83	8·00								
		600	− 0·91	34·62	27·86	8·00								
		700	− 0·90	35·01	28·18	8·01								
00	3	0	− 0·70	34·20	27·52	8·09	—	—	**N 50 V**	100–0	1445			
		10	− 0·70	34·20	27·52	8·09	—	—	**N 70 V**	50–0				
		20	− 0·70	34·25	27·56	8·09	—	—	,,	100–50				
		30	− 0·70	34·16	27·49	8·09	—	—	,,	250–100				
		40	− 0·64	34·18	27·50	8·09	—	—	,,	300–250	—	1545		
		50	− 0·64	34·16	27·48	8·09	—	—	**N 100 H**	0–5	1602	1641	1	
		60	− 0·70	34·16	27·49	8·09	—	—	,,	69	,,	,,	1	? not fishing properly
		80	− 0·70	34·21	27·52	8·09	—	—	,,	138	,,	,,	1	KT
		100	− 0·70	34·21	27·52	8·09	—	—	**N 70 H**	0–5	1659	1716	¼	
		150	− 0·78	34·25	27·56	8·07	—	—	,,	56(–0)	,,	,,	¼	
		200	− 0·86	34·36	27·65	8·07	—	—	,,	113(–0)	,,	,,	¼	KT
		275	− 0·90	34·57	27·83	8·07								
01	4	0	− 0·50	34·07	27·41	8·12	—	—	**N 50 V**	100–0	0820			
		10	− 0·50	34·08	27·42	8·10	—	—	**N 70 V**	50–0				
		20	− 0·50	34·08	27·42	8·10	—	—	,,	100–50				
		30	− 0·50	34·11	27·44	8·09	—	—	,,	250–100				
		40	− 0·50	34·15	27·47	8·10	—	—	,,	330–250	—	0910		
		50	− 0·48	34·17	27·48	8·08	—	—	**N 100 H**	0–5	0930	1012	1	
		60	− 0·47	34·17	27·48	8·05	—	—	,,	60	,,	,,	1	
		80	− 0·61	34·18	27·50	8·04	—	—	,,	120(–0)	,,	,,	1	KT. Net torn
		100	− 0·72	34·27	27·58	7·99	—	—	**N 70 H**	0–5	1047	1054	¼	
		150	− 0·85	34·36	27·65	7·98	—	—	,,	45(–0)	1026	1041	¼	
		200	− 0·90	34·45	27·73	7·98	—	—	,,	90(–0)	,,	,,	¼	KT
		300	− 0·90	34·47	27·75	7·98								
02	4	0	0·08	33·83	27·18	8·14	—	—	**N 50 V**	100–0	1720			
		10	− 0·02	33·84	27·19	8·14	—	—	**N 70 V**	50–0				
		20	− 0·02	33·84	27·19	8·12	—	—	,,	100–50				
		30	− 0·02	33·82	27·18	8·12	—	—	,,	250–100				
		40	− 0·02	33·87	27·22	8·12	—	—	,,	500–250				
		50	− 0·02	33·93	27·26	8·11	—	—	,,	750–500	—	1915		
		60	0·00	33·99	27·31	8·10	—	—	**N 100 H**	0–5	1930	2030	1	
		80	0·00	34·05	27·36	8·06	—	—	,,	94	,,	,,	1	
		100	0·00	34·13	27·42	8·02	—	—	,,	188(–0)	,,	,,	1	KT
		150	0·15	34·28	27·53	7·99	—	—	**N 70 H**	0–5	2050	2059	¼	
		200	0·30	34·37	27·60	7·99	—	—	,,	62	,,	,,	¼	
		300	0·36	34·45	27·66	8·01	—	—	,,	124	,,	,,	¼	KT
		350	− 0·95	34·38	27·68	7·96								
		400	− 0·92	34·42	27·70	7·99								
		600	− 0·92	34·63	27·88	8·00								
		850	− 1·03	34·43	27·72	8·02								
03	4	0	− 0·10	34·00	27·32	8·14	—	—	**N 50 V**	100–0	2240			
		10	− 0·14	33·95	27·29	8·15	—	—	**N 70 V**	50–0				
		20	− 0·12	33·95	27·29	8·15	—	—	,,	100–50				
		30	− 0·11	33·96	27·30	8·13	—	—	,,	250–100				
		40	− 0·10	34·00	27·32	8·13	—	—	,,	500–250				
		50	− 0·12	34·00	27·33	8·12	—	—	,,	750–500				
		60	− 0·31	34·16	27·47	8·00	—	—	,,	930–750	—	0030		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
203 *cont.*	Bransfield Strait, S Shetlands, 62° 56′ 00″ S, 59° 50′ 00″ W	1927 5-6 iv										
204	Bransfield Strait, S Shetlands, 63° 05′ 00″ S, 59° 42′ 00″ W	6 iv	0800	943 di. oz.	W	3	W	2	b. c.	992·4	− 3·3	
205	Bransfield Strait, S Shetlands, 63° 14′ 00″ S, 59° 34′ 00″ W	6 iv	1200	235 r.	SW	2	SW	2	b. c. s.	992·9	− 2·2	
206	Bransfield Strait, S Shetlands, 63° 26′ 00″ S, 59° 28′ 00″ W	6 iv	1545	310 m. di. oz.								
			1600	—	—	1	—	1	o. s.	992·2	− 1·7	
207	Bransfield Strait, S Shetlands. From 62° 54′ 00″ S, 59° 50′ 30″ W to 62° 49′ 30″ S, 60° 10′ 30″ W	7 iv	0400	—	NW	4	NW	4	b. c.	991·8	− 2·8	
			0800	—	NW	6	NW	3	c. s.	992·0	0·0	
208	Off Livingston I, S Shetlands, 62° 49′ 30″ S, 60° 10′ 30″ W	7 iv	1200	—	NW	6	NW	3	c. g. s.	990·6	− 0·6	
209	Port Foster, Deception I, S Shetlands	14 iv	0800	—	—	1	—	0	c.	980·3	− 1·1	
			0900	168 m.								

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
03		80	− 0·42	34·22	27·51	8·00	—	—	**N 100 H**	0–5	**0045**	**0119**	1	
tt.		100	− 0·55	34·25	27·55	8·00	—	—	,,	90	,,	,,	1	
		150	− 0·89	34·34	27·64	8·00	—	—	,,	180	,,	,,	1	KT
		200	− 0·96	34·36	27·66	8·00	—	—	**N 70 H**	0–5	**0135**	**0146**	¼	
		300	− 0·94	34·42	27·70	8·00	—	—	,,	68	,,	,,	¼	
		400	− 0·96	34·46	27·73	8·01	—	—	,,	139	,,	,,	¼	KT
		600	− 0·77	34·49	27·75	8·01								
		800	− 0·99	34·51	27·78	8·01								
		900	− 1·10	34·53	27·80	8·02								
04	5	0	− 0·25	34·01	27·34	8·12	—	—	**N 50 V**	100–0	0800	—	—	TD 19 m.
		10	− 0·29	34·00	27·34	8·12	—	—	**N 70 V**	50–0				
		20	− 0·29	34·00	27·34	8·11	—	—	,,	100–50				
		30	− 0·25	34·04	27·36	8·09	—	—	,,	250–100				
		40	− 0·25	34·04	27·36	8·09	—	—	,,	500–250				
		50	− 0·20	34·02	27·35	8·06	—	—	,,	750–500	—	0907		
		60	− 0·30	34·05	27·38	8·06	—	—	**N 100 H**	0–5	0921	0953	1	
		80	− 0·31	34·13	27·44	8·03	—	—	,,	77	,,	,,	1	
		100	− 0·32	34·13	27·44	8·01	—	—	,,	155	,,	,,	1	KT
		150	− 0·59	34·22	27·52	7·98	—	—	**N 70 H**	0–5	1008	1020	¼	
		200	− 0·74	34·29	27·59	7·98	—	+	,,	78	,,	,,	¼	
		300	− 0·89	34·37	27·67	7·98	—	+	,,	159	,,	,,	¼	KT
		400	− 0·93	34·42	27·70	7·98								
		600	− 0·80	34·50	27·76	7·98								
		800	− 0·93	34·45	27·73	8·00								
05	5	0	− 0·15	34·00	27·33	8·12	—	—	**N 50 V**	100–0	1200	—	—	TD 15½ m.
		10	− 0·20	34·04	27·36	8·12	—	—	**N 70 V**	50–0				
		20	− 0·20	34·04	27·36	8·10	—	—	,,	100–50				
		30	− 0·17	34·04	27·36	8·10	—	—	,,	225–100	–	1217		
		40	− 0·39	34·07	27·40	8·07	—	—	**N 100 H**	0–5	1247	1316	1	
		50	− 0·42	34·07	27·40	8·07	—	—	,,	59	,,	,,	1	
		60	− 0·38	34·14	27·46	8·04	—	—	,,	119	,,	,,	1	KT
		80	− 0·66	34·28	27·57	8·02	—	—	**N 70 H**	0–5	1330	1341	¼	
		100	− 0·78	34·32	27·61	8·00	—	—	,,	62	,,	,,	¼	
		150	− 0·92	34·39	27·68	8·00	—	—	,,	124	,,	,,	¼	KT
		215	− 0·94	34·46	27·74	7·98								
06	5	0	− 0·78	34·06	27·41	8·10	—	—	**N 50 V**	100–0	1545	—	—	TD 26 m.
		10	− 0·77	34·06	27·41	8·10	—	—	**N 70 V**	50–0				
		20	− 0·77	34·07	27·42	8·10	—	—	,,	100–50				
		30	0·77	34·05	27·40	8·08	–	–	,,	250–100	—	1615		
		40	− 0·63	34·07	27·41	8·04	—	—	**N 100 H**	0–5	1646	**1734**	1	net torn
		50	− 0·45	34·13	27·44	8·04	—	—	,,	66	,,	,,	1	
		60	− 0·46	34·13	27·44	8·02	—	—	,,	132	,,	,,	1	KT
		80	− 0·60	34·16	27·48	8·00	—	—	**N 70 H**	0–5	**1750**	**1806**	¼	
		100	− 0·55	34·20	27·51	7·98	—	—	,,	65	,,	,,	¼	
		150	− 0·62	34·27	27·57	7·98	—	—	,,	130	,,	,,	¼	KT
		200	− 0·60	34·30	27·59	7·98								
		300	− 0·81	34·34	27·64	8·00								
07	6	—	—	—		—	—		**N 70 H**	0–5	**0300** / 0814	**0310** / 0824	0·3	32 consecutive hauls (A–GG) of 10 mins. duration. Sunrise 0645
									,,	0–5			0·3	
08	6	787	− 0·86	—	—		—	-	**TYF**	800(–0)	0920	1000	1·0	DGT
09	13	0	0·03	33·75	27·12	8·02	—	—	**N 50 V**	100–0	0900	—	—	TD 9 m.
		10	0·12	33·75	27·11	8·02	—	—	**N 70 V**	50–0				
		20	0·12	33·75	27·11	7·99	—	—	,,	100–50				
		30	0·12	33·77	27·12	7·97	—	—	,,	150–100	—	0940		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
209 *cont.*	Port Foster, Deception I, S Shetlands	14 iv										
210	Boyd Strait, S Shetlands. From 62° 47′ 00″ S, 62° 10′ 00″ W to 62° 39′ 30″ S, 62° 28′ 30″ W	14–15 iv	2000	—	SW	4	SW	3	b. c.	986·4	0·0	mod. SW swell
			0000	—	SW	4	SW	3	b. c.	989·0	− 1·1	,,
			0400	—	WSW	3	—	1	b.	990·3	− 1·1	,,
211	Drake Strait, 62° 35′ 00″ S, 63° 20′ 00″ W	15 iv	0800	—	NW	4	NW	3	o.	991·6	− 0·6	mod. SW swell
			1130	2865 di. oz.								
			1200	—	NW	4	NW	3	c. s. q.	994·2	0·0	slight NW swell
			1600	—	NW	4	NW	3	b. c.	994·8	0·6	,,
212	Drake Strait, 61° 15′ 00″ S, 64° 42′ 50″ W	16 iv	0700	3350 di. oz.								
			0800	—	—	1	—	1	b. c.	999·6	0·6	heavy NW swell
			1200	—	NE	5	NE	4	o. s.	993·7	0·6	,,
213	Drake Strait, 60° 45′ 30″ S, 65° 27′ 30″ W	16 iv	2000	—	NNE	3	NNE	2	o. r.	987·6	2·2	heavy NW swell
			0000	—	NNE	4	NNE	3	o. f. r.	984·2	1·7	mod. NW swell
214	Drake Strait, 60° 11′ 00″ S, 66° 15′ 00″ W	17 iv	0745	*ca.* 4000								
			0800	—	SW	4	SW	2	o. d.	979·1	1·7	
			1200	—	SW	6	SW	6	o. d.	981·6	3·9	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
09		40	0·12	33·77	27·12	7·97								
nt.		50	0·10	33·83	27·17	7·97								
		60	0·09	33·84	27·18	7·97								
		80	0·00	33·82	27·18	7·97								
		100	− 0·20	33·89	27·24	7·96								
		130	− 1·28	33·96	27·35	7·65								
		160	− 1·51	34·07	27·45	7·67								
10	13	—	—	—	—	—	—	—	**N 70 H**	0–5	**2200**	**2210**	0·2	40 consecutive hauls (A–PP) of 10 mins.
											/	/		
									,,	0–5	**0430**	**0440**	0·2	duration. Moonlight, moon set 0400
11	14	0	0·49	33·64	27·00	8·16	—	7·52	**N 50 V**	100–0	0910	—	—	TD 26 m.
		10	0·23	33·64	27·02	8·16	—	—	**N 70 V**	50–0				
		20	0·22	33·63	27·01	8·16	—	7·61	,,	100–50				
		30	0·22	33·66	27·03	8·13	—	—	,,	250–100				
		40	0·25	33·62	27·00	8·09	—	7·94	,,	500–250				
		50	0·25	33·65	27·01	8·09	—	—	,,	750–500				
		60	0·23	33·65	27·02	8·09	—	7·68	,,	1000–750				
		80	− 0·50	33·96	27·32	8·03	—	6·80	,,	2000–1600	—	1210		
		100	− 0·05	34·09	27·39	7·98	—	—	**N 100 H**	0–5	1315	1352	1	
		150	1·51	34·44	27·57	7·98	—	4·52	,,	58	,,	,,	1	
		200	1·75	34·52	27·63	7·96	—	4·26	,,	117	,,	,,	1	KT
		300	1·76	34·59	27·68	7·96	—	4·26	**N 70 H**	0–5	1408	1423	¼	
		400	1·72	34·63	27·72	7·96	—	4·34	,,	64	,,	,,	¼	
		600	1·62	34·69	27·77	7·96	—	4·54	,,	128	,,	,,	¼	KT
		800	1·44	34·66	27·76	7·96	—	4·54						
		1000	1·31	34·65	27·76	7·97	—	4·54						
		1500	0·91	34·65	27·79	7·97	—	4·61						
		2000	0·62	34·65	27·80	7·97	—	4·88						
		2800	0·45	34·64	27·80	7·97	—	4·97						
12	14	0	1·16	33·68	26·99	8·16	—	7·68	**N 50 V**	100–0	0700			
		10	1·16	33·68	26·99	8·16	—	—	**N 70 V**	50–0				
		20	1·15	33·68	26·99	8·16	—	7·54	,,	100–50				
		30	1·15	33·68	26·99	8·16	—	—	,,	250–100				
		40	1·11	33·69	27·00	8·16	—	7·54	,,	500–250				
		50	1·10	33·71	27·02	8·16	—	—	,,	750–500				
		60	1·10	33·71	27·02	8·15	—	7·61	,,	1000–750				
		80	0·76	33·72	27·04	8·12	—	—	,,	1500–1000	—	1115		
		100	0·08	33·95	27·28	8·07	—	7·30	**NH**	0	1000			
		150	0·72	34·08	27·34	8·01								
		200	1·38	34·20	27·40	7·98								
		300	2·00	34·40	27·51	7·96								
		400	2·08	34·49	27·57	7·95	—	4·29						
		600	2·22	34·56	27·62	7·96								
		800	2·14	34·62	27·68	7·96								
		1000	2·04	34·66	27·72	7·97	—	4·29						
		1500	1·71	34·70	27·77	7·98								
		2100	1·28	34·71	27·81	7·98	—	4·63						
		3200	0·59	34·72	27·86	7·98	—	4·74						
13	14	—	—	—	—	—	—	—	**N 100 H**	0–5	**2206**	**2235**	1	
									,,	59	,,	**2233**	1	
									,,	119	,,	**2234**	1	KT
									N 70 H	0–5	**2249**	**2303**	½	
									,,	65	,,	,,	½	
									,,	131	,,	,,	½	KT
14	15	0	1·93	33·80	27·04	8·16	—	7·45	**N 50 V**	100–0	0745			
		10	1·93	33·80	27·04	8·16	—	—	**N 70 V**	50–0				
		20	1·98	33·80	27·03	8·16	—	7·39	,,	100–50				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
214 *cont.*	Drake Strait, 60° 11′ 00″ S, 66° 15′ 00″ W	1927 17 iv										
215	Drake Strait, 59° 58′ 00″ S, 67° 02′ 00″ W	17 iv	2000	—	SW	7	SW	7	o. g. h.	987·3	1·1	
			0000	—	SW	7	SW	7	o. g. h.	990·1	0·6	
216	Drake Strait, 58° 53′ 00″ S, 67° 55′ 00″ W	18 iv	1155	3650 r.								
			1200	—	NNW	4	NNW	3	b. c.	988·4	4·4	heavy W swell
			1600	—	NNW	4	NNW	3	b. c.	985·9	4·4	,,
217	Drake Strait, 58° 27′ 30″ S, 67° 55′ 00″ W	18 iv	2000	—	NNW	4	NNW	3	b. c.	985·6	4·4	heavy W swell
			0000	—	NNW	6	NNW	6	b. c.	984·4	5·0	,,
218	Drake Strait, 57° 32′ 00″ S, 67° 04′ 00″ W [station repeated on 21 iv, St. **219**]	19 iv	1200	4650	NW	6	NW	6	o. r. g.	979·1	5·6	heavy NW and ESE swell

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
14		30	1·96	33·81	27·04	8·16	—	—	**N 70 V**	250–100				
t.		40	1·93	33·81	27·05	8·16	—	7·32	,,	500–250				
		50	1·93	33·82	27·06	8·16	—	—	,,	750–500				
		60	1·92	33·82	27·06	8·15	—	7·43	,,	1000–750				
		80	1·91	33·82	27·06	8·15	—	—	,,	2000–1000	—	1215		
		100	1·89	33·82	27·06	8·14	—	7·41						
		150	1·25	33·99	27·23	8·09								
		200	1·54	34·06	27·28	8·09								
		300	1·57	34·16	27·35	8·02								
		400	2·20	34·22	27·34	7·99	—	6·73						
		600	2·39	34·35	27·44	7·95								
		800	2·34	34·49	27·55	7·95								
		1000	2·28	34·58	27·64	7·95	—	4·23						
		1500	2·07	34·67	27·72	7·97								
		2000	1·79	34·69	27·75	7·99	—	4·34						
15	15	—	—	—	—	—	—	—	**N 100 H**	0–5	**2216**	**2251**	1	
									,,	60(–0)	,,	,,	1	
									,,	120(–60)	,,	,,	1	KT
									N 70 H	0–5	**2309**	**2321**	¼	
									,,	64	,,	,,	¼	
									,,	128	,,	,,	¼	KT
16	16	0	3·92	34·00	27·02	8·18	—	6·80	**N 50 V**	100–0	1155	—	—	TD 32½ m.
		10	3·91	33·99	27·02	8·18	—	—	**N 70 V**	50–0				
		20	3·90	34·00	27·02	8·18	—	6·96	,,	100–50				
		30	3·90	34·05	27·06	8·18	—	—	,,	250–100				
		40	3·90	34·05	27·06	8·18	—	—	,,	500–250				
		50	3·90	34·05	27·06	8·16	—	—	,,	750–500				
		60	3·90	34·05	27·06	8·16	—	6·96	,,	1000–750				
		80	3·90	34·09	27·09	8·16	—	—	,,	1500–1000	—	1550	—	net foul
		100	3·89	34·09	27·09	8·16	—	6·93						
		150	3·58	34·11	27·14	8·12								
		200	2·92	34·13	27·22	8·10								
		300	3·22	34·18	27·24	8·07								
		400	2·80	34·21	27·29	8·04	—	6·44						
		600	2·51	34·30	27·39	7·98								
		800	2·53	34·45	27·51	7·97								
		1000	2·38	34·54	27·60	7·96	—	4·26						
		1500	2·19	34·70	27·74	7·96								
		2000	1·87	34·74	27·80	7·97	—	4·29						
		3500	0·91											
17	16	—	—	—	—	—	—	—	**N 100 H**	0–5	**2207**	**2244**	1	
									,,	77	,,	,,	1	
									,,	155	,,	,,	1	KT
									N 70 H	0–5	**2316**	**2325**	¼	
									,,	53	**2258**	**2312**	¼	
									,,	106(–0)	,,	,,	¼	KT
18	17	0	5·86	34·13	26·90	8·18	—	—	**N 50 V**	100–0	1205	—	—	high wind and rough sea; much stray on wires. Depths of water-bottles and nets below 100 m. unreliable. Nets below 250 m. not fishing properly
		10	5·85	34·13	26·90	8·18	—	—	**N 70 V**	50–0				
		20	5·85	34·14	26·92	8·18	—	—	,,	100–50				
		30	5·84	34·14	26·92	8·18	—	—	,,	250–180				
		40	5·83	34·14	26·92	8·18	—	—	,,	500–230				
		50	5·83	34·14	26·92	8·18	—	—	,,	750–500				
		60	5·83	34·14	26·92	8·18	—	—	,,	1000–750	—	1430	—	
		80	5·83	34·14	26·92	8·18								
		100	5·83	34·14	26·92	8·18								
		150	5·20	34·20	27·04	8·15								
		200	4·98	34·23	27·09	8·11								

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
218 *cont.*	Drake Strait, 57° 32′ 00″ S, 67° 04′ 00″ W	1927 19 iv										
219	Drake Strait, 57° 32′ 00″ S, 67° 04′ 00″ W	21 iv	1200	—	SSW	4	NE	4	b. c.	986·6	5·6	v. heavy conf. sw
			1600	—	SSW	4	NE	4	b. c.	985·7	4·4	,,
220	Drake Strait, 57° 16′ 00″ S, 67° 06′ 00″ W	21 iv	2000	—	NE	4	NE	4	c. q. r.	987·8	3·3	v. heavy conf. sw
			0000	—	NE	4	NE	4	o.	991·6	3·9	,,
221	Drake Strait, 56° 11′ 40″ S, 67° 32′ 30″ W	22 iv	1200	—	SW	5	SW	6	b. c.	1004·8	6·1	heavy W swell
			1255	112 r. sh.								
222	St Martin's Cove, Hermite I, Cape Horn	23 iv	0800	—	SW	2–5	—	o	o. g. r.	999·6	8·3	
			1200	—	SW	3	—	o	o. g. r.	996·7	7·2	
			1600	—	SW	2–4	—	o	o. g. r.	996·9	7·2	
		24 iv	1200	—	SW	2–5	—	o	o. g. r.	985·7	6·7	
		25 iv	1600	—	SW	3–8	—	o	o. g. r.	989·4	9·4	
223	St Francis' Bay, C Horn, 55° 51′ 15″ S, 67° 29′ 30″ W	27 iv	0730	—	N	4	—	o	b. c.	1009·3	6·1	
			0853	63 s.								
224	Off Cape Horn, 55° 46′ 30″ S, 66° 36′ 00″ W	27 iv	2000	—	N × E	6	N × E	5	o.	993·1	6·7	mod. N swell
			0000	—	N × E	7–8	N × E	6	o.	988·5	8·3	,,

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
18		300	4·89	34·23	27·10	8·11								
tt.		400	4·89	34·26	27·12	8·09								
		600	4·54	34·23	27·14	8·09								
		800	4·37	34·23	27·16	8·07								
		1000	3·94	34·23	27·21	8·04								
19	19	0	5·88	34·11	26·88	8·18	—	6·93	**N 50 V**	100–0	1200	—	—	TD 27 m.
		10	5·88	34·11	26·88	8·18	—	—	**N 70 V**	50–0				
		20	5·87	34·13	26·90	8·18	—	6·73	,,	100–50				
		30	5·87	34·11	26·89	8·18	—	—	,,	250–100				
		40	5·87	34·13	26·90	8·18	—	—	,,	500–250				
		50	5·86	34·14	26·92	8·18	—	—	,,	750–500				
		60	5·86	34·16	26·93	8·18	—	6·73	,,	1000–750	–	1550		
		80	5·86	34·16	26·93	8·18								
		100	5·83	34·16	26·93	8·14	—	6·73						
		150	5·80	34·19	26·96	8·12								
		200	5·01	34·23	27·09	8·10								
		300	4·80	34·24	27·11	8·10								
		400	4·64	34·27	27·16	8·10	—	6·75						
		600	4·35	34·27	27·19	8·10								
		800	3·95	34·29	27·24	8·05								
		1000	3·41	34·33	27·33	7·99	—	4·93						
		1500	2·65	34·52	27·56	7·94								
		2000	2·46	34·61	27·65	7·98	—	3·80						
		3000	1·95	34·69	27·74	7·98	—	3·84						
20	19	—	--	—	—	—	—	—	**N 100 H**	0–5	**2215**	**2248**	1	
									,,	63	,,	,,	1	
									,,	126	,,	,,	1	KT
									N 70 H	0–5	**2305**	**2317**	¼	
									,,	68	,,	,,	¼	
									,,	137(–68)	,,	,,	¼	KT. ? not fishing properly
21	20	0	8·80	33·46	25·96	8·20	—	6·44	**N 50 V**	100–0	1255	—	—	TD 18 m.
		10	8·35	33·46	26·03	8·19	—	—	**N 70 V**	50–0				
		20	8·35	33·46	26·03	8·18	—	6·37	,,	100–50	—	1330		
		30	8·50	33·51	26·06	8·16								
		40	8·47	33·51	26·06	8·17	—	6·33						
		50	8·40	33·56	26·10	8·17								
		60	8·46	33·66	26·17	8·18	—	6·44						
		80	8·23	33·71	26·26	8·16	—	6·33						
		98	8·08	33·77	26·32	8·16	—	6·33						
22	21–23	0	8·70	32·48	25·20	—	—	—	**TNL**	30	—		—	22–23 iv
		10	8·56	32·79	25·47	—	—	—	**NRL**	30–35	0950	1015	—	23 iv
		20	8·57	32·81	25·48	—	—	—	**NCS–N**					
		33	8·66	32·90	25·53	—	—	—	**N 70 H**	0–5	1000	1010	—	23 iv
									Sh. coll.	—	1430	1600	—	23 iv
									TNL	35	—	—	—	23–24 iv
									Sh. coll.	—	1500	1630	—	25 iv. Freshwater lakes, 300–350 ft.
23	25	—		—	—	—	—	—	**NRL**	63	0858	0905		
									NCS–N					
24	25	—	—	—	—	—	—	—	**N 100 H**	0–5	**2118**	**2155**	1	
									,,	55	,,	,,	1	
									,,	110	,,	,,	1	KT
									N 70 H	0–5	**2210**	**2221**	¼	
									,,	56	,,	,,	¼	
									,,	113	,,	,,	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
225	54° 28′ 30″ S, 65° 18′ 30″ W	1927 29 iv	1500	91 r.	NW	4	NW	3	b. c.	973·9	9·4	
			1600	—								
226	54° 15′ 00″ S, 64° 18′ 00″ W	1 v	1200	—	WSW	5	WSW	5	b. c.	994·7	3·9	mod. NW swell
			1230	133 c. s. st.								
227	54° 02′ 00″ S, 63° 16′ 00″ W	1 v	2000	—	NW	4	NW	3	b. c.	996·7	6·1	
			2130	578 r.								
			0000	—	NW	5	NW	3	o.	995·4	5·6	
228	53° 33′ 00″ S, 61° 49′ 30″ W	2 v	0800	660 di. oz.	NW	5	NW	4	c.	993·7	7·2	heavy WSW sw
			1200	—	NW	6	NW	6	b. c.	992·4	8·3	,,
229	53° 40′ 00″ S, 61° 10′ 00″ W	4 v	1600	—	WNW	4	WNW	3	o. r.	999·9	3·9	v. heavy W swell
			1640	384 s. st.								
			2000	—	W	2	W	1	o.	1002·2	5·0	,,

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
225	27	0	8·08	32·69	25·47	8·19	—	—	**N 50 V**	75–0	1500	—	—	TD 19 m.
		5	8·08	32·68	25·47	8·19	—	—	**N 70 V**	50–0				
		10	8·08	32·66	25·45	8·18	—	—	,,	85–50	—	1525		
		20	8·08	32·68	25·47	8·18	—	—	**N 100 H**	0–5	1539	1612	1	
		30	8·08	32·68	25·47	8·18	—	—	,,	32	,,	,,	1	
		40	8·08	32·68	25·47	8·18	—	—	,,	64	,,	,,	1	KT
		50	8·08	32·70	25·48	8·18	—	—	**N 70 H**	0–5	1624	1634	¼	
		60	8·08	32·70	25·48	8·18	—	—	,,	36	,,	,,	¼	
		85	8·08	32·72	25·50	8·18	—	—	,,	73	,,	,,	¼	KT
226	1	0	7·50	33·45	26·14	8·18	—	—	**N 50 V**	100–0	1230	—	—	TD 25 m.
		10	7·51	33·45	26·14	8·18	—	—	**N 70 V**	50–0				
		20	7·52	33·41	26·12	8·18	—	—	,,	100–50				
		30	7·52	33·41	26·12	8·18	—	—	,,	130–100	—	1304		
		40	7·52	33·43	26·13	8·18	—	—	**N 100 H**	0–5	1326	1347	1	
		50	7·52	33·44	26·14	8·18	—	—	,,	41	,,	,,	1	
		60	7·52	33·47	26·16	8·18	—	—	,,	82	,,	,,	1	KT
		80	7·52	33·47	26·16	8·17	—	—	**N 70 H**	0–5	1405	1416	¼	
		100	7·52	33·48	26·17	8·17	—	—	,,	47	,,	,,	¼	
		130	7·52	33·48	26·17	8·17	—	—	,,	95	,,	,,	¼	KT
227	1	0	7·20	33·64	26·34	8·18	—	—	**N 50 V**	100–0	**2130**			
		10	7·20	33·69	26·38	8·18	—	—	**N 70 V**	50–0				
		20	7·17	33·71	26·41	8·18	—	—	,,	100–50				
		30	7·13	33·71	26·41	8·18	—	—	,,	250–100				
		40	7·10	33·74	26·44	8·18	—	—	,,	500–250	—	**2230**		
		50	7·03	33·77	26·47	8·18	—	—	**N 100 H**	0–5	**2247**	**2316**	1	
		60	6·83	33·81	26·53	8·18	—	—	,,	76	,,	,,	1	
		80	6·54	33·91	26·66	8·16	—	—	,,	152	,,	,,	1	KT
		100	6·41	33·97	26·71	8·15	—	—	**N 70 H**	0–5	**2330**	**2344**	¼	
		150	6·03	34·00	26·78	8·12	—	—	,,	85	,,	,,	¼	
		200	5·87	34·05	26·84	8·05	—	—	,,	170	,,	,,	¼	KT. Not fishing properly
		300	4·63	34·13	27·04	8·05								
		400	4·42	34·11	27·05	8·05								
		550	4·33	34·13	27·07	8·05								
228	2	0	6·31	33·97	26·72	8·18	—	—	**N 50 V**	100–0	0755	—	—	TD 23½ m.
		10	6·31	34·02	26·76	8·18	—	—	**N 70 V**	50–0				
		20	6·29	34·02	26·76	8·18	—	—	,,	100–50				
		30	6·30	34·02	26·76	8·18	—	—	,,	250–100				
		40	6·30	33·99	26·74	8·18	—	—	,,	500–250				
		50	6·29	34·03	26·76	8·18	—	—	,,	650–500		0935		
		60	6·25	34·03	26·76	8·18	—	—	**N 100 H**	0–5	0942	1009	1	
		80	5·87	34·04	26·83	8·16	—	—	,,	40(–0)	,,	,,	1	
		100	5·13	34·05	26·92	8·16	—	—	,,	80(–40)	,,	,,	1	KT
		150	4·46	34·11	27·05	8·12	—	—	**N 70 H**	0–5	1022	1030	¼	
		200	4·41	34·12	27·06	8·10	—	—	,,	45	,,	,,	¼	? not fishing properly
		300	4·19	34·13	27·09	8·06	—	—	,,	90	,,	,,	¼	KT. ? not fishing properly
		400	4·12	34·09	27·07	8·06								
		500	4·07	34·11	27·09	8·08								
		620	3·93	34·08	27·08	8·10								
229	4	0	6·17	33·95	26·72	8·18	—	—	**N 50 V**	100–0	**1640**			
		10	6·17	33·96	26·73	8·18	—	—	**N 70 V**	50–0				
		20	6·17	33·95	26·72	8·18	—	—	,,	100–50				
		30	6·17	33·97	26·74	8·18	—	—	,,	250–100				
		40	6·17	33·97	26·74	8·18	—	—	,,	370–250		1735		
		50	6·17	33·98	26·75	8·18	—	—	**N 100 H**	0–5	**1809**	**1842**	1	
		60	6·17	33·97	26·74	8·18	—	—	,,	46(–0)	,,	**1837**	1	mass of kelp on release gear
		80	6·17	33·99	26·75	8·16	—	—	,,	92	,,	**1838**	1	KT
		100	6·13	33·98	26·76	8·16	—	—	**N 70 H**	0–5	**1929**	**1944**	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. °C. Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
229 *cont.*	53° 40′ 00″ S, 61° 10′ 00″ W	4 v										
230	53° 17′ 00″ S, 60° 25′ 00″ W	5 v	1600	—	W	5	W	4	b. c.	1009·0	8·9	heavy SW swell
			1740	675 m.								
			2000	—	W	3	W	2	o.	1020·0	8·3	,,
231	51° 29′ 30″ S, 57° 18′ 15″ W	28 v	1600	—	NNE	3	NNE	2	b. c. h.	1004·6	1·7	
			1645	143 s. sh.								
232	51° 19′ 45″ S, 57° 07′ 00″ W	28 v	2000	—	—	0–1	—	0	c.	1004·1	2·8	slight E swell
			2035	169 s. r.								
			0000	—	N	3	—	0	b. c.	1000·4	1·7	
233	51° 07′ 40″ S, 56° 53′ 00″ W	29 v	0800	—	WNW	2	WNW	2	b. c.	1005·3	3·9	
			0915	374 r.								
			1200	—	N × W	4	N × W	2	b. c.	1007·7	5·0	
234	50° 53′ 50″ S, 56° 36′ 30″ W	29 v	1325	492 r.								
			1600	—	N × W	3	N × W	2	c.	1007·1	2·8	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
29		150	5·84	34·00	26·80	8·16	—	—	**N 70 H**	65	**1857**	**1916**	¼	
nt.		200	5·24	34·05	26·91	8·11	—	—	,,	130	**1929**	**1943**	¼	KT. ? not fishing properly
		300	4·65	34·09	27·01	8·07								
		315	4·54	34·13	27·05	8·07								water-bottle touched bottom
30	5	0	6·31	34·02	26·76	8·18	—	—	**N 50 V**	100–0	**1740**			
		10	6·31	34·02	26·76	8·18	—	—	**N 70 V**	50–0				
		20	6·27	34·03	26·77	8·18	—	—	,,	100–50				
		30	6·26	34·03	26·77	8·18	—	—	,,	250–100				
		40	6·26	34·03	26·77	8·18	—	—	,,	500–250				
		50	6·25	34·04	26·78	8·18	—	—	,,	660–500	—	**1855**		
		60	6·25	34·05	26·79	8·18	—	—	**N 100 H**	0–5	**1917**	**1942**	1	
		80	6·23	34·06	26·80	8·16	—	—	,,	70	,,	,,	1	
		100	6·05	34·09	26·84	8·13	—	—	,,	141	,,	,,	1	KT
		150	5·51	34·13	26·94	8·13	—	—	**N 70 H**	0–5	**1955**	**2008**	¼	
		200	5·33	34·15	26·99	8·09	—	—	,,	77	,,	,,	¼	
		300	4·65	34·18	27·09	8·07	—	—	,,	155	,,	,,	¼	KT
		400	4·41	34·18	27·11	8·07								
		520	4·28	34·23	27·17	8·21								
		650	5·23	34·22	27·05	8·21								
31	26	0	6·43	33·75	26·53	8·20	—	—	**N 50 V**	100–0	**1645**			
		10	6·47	33·75	26·53	8·20	—	—	**N 70 V**	50–0				
		20	6·47	33·75	26·53	8·20	—	—	,,	100–50				
		30	6·47	33·75	26·53	8·20	—	—	,,	135–100	—	**1720**		
		40	6·47	33·75	26·53	8·20	–	–	**N 100 H**	0–5	**1748**	**1814**	1	
		50	6·45	33·75	26·53	8·20	—	—	,,	45	,,	,,	1	
		60	6·45	33·76	26·53	8·15	—	—	,,	90	,,	,,	1	KT
		80	6·50	33·79	26·55	8·15	—	—	**N 70 H**	0–5	**1845**	**1901**	¼	
		100	6·49	33·82	26·59	8·13	—	—	,,	37	,,	**1859**	¼	
		135	6·43	33·83	26·59	8·13	–	—	,,	74	,,	**1900**	¼	KT
32	26	0	6·53	33·75	26·52	8·18	—	—	**N 50 V**	100–0	**2035**			
		10	6·53	33·75	26·52	8·18	—	—	**N 70 V**	50–0				
		20	6·53	33·75	26·52	8·18	—	—	,,	100–50				
		30	6·54	33·75	26·52	8·18	—	—	,,	160–100	—	**2120**		
		40	6·54	33·75	26·52	8·18	—	—	**N 100 H**	0–5	**2137**	**2206**	1	
		50	6·53	33·75	26·52	8·18	—	—	,,	47	,,	,,	1	? not fishing properly
		60	6·53	33·77	26·53	8·18	—	—	,,	95	,,	,,	1	KT
		80	6·53	33·77	26·53	8·16	—	—	**N 70 H**	0–5	**2224**	**2238**	¼	
		100	6·55	33·78	26·55	8·16	—	—	,,	45	,,	,,	¼	
		160	6·45	33·78	26·56	8·15	—	—	,,	91(–45)	,,	,,	¼	KT
33	27	0	6·23	33·84	26·63	8·18	—	—	**N 50 V**	100–0	0915	—	—	TD 24 m.
		10	6·24	33·84	26·63	8·18	—	—	**N 70 V**	50–0				
		20	6·25	33·84	26·63	8·18	—	—	,,	100–0				
		30	6·25	33·84	26·63	8·18	—	—	,,	250–100				
		40	6·25	33·84	26·63	8·18	—	—	,,	350–250	—	1025		
		50	6·30	33·84	26·62	8·18	—	—	**N 100 H**	0–5	1036	1108	1	
		60	6·19	33·85	26·64	8·15	—	—	,,	72	,,	,,	1	
		80	6·03	33·86	26·67	8·15	—	—	,,	145	,,	,,	1	KT
		100	6·05	33·88	26·69	8·14	—	—	**N 70 H**	0–5	1123	1134	¼	
		150	5·98	33·93	26·72	8·15	—	—	,,	56	,,	,,	¼	
		200	5·73	34·00	26·81	8·12	—	—	,,	112	,,	,,	¼	KT
		275	5·13	34·07	26·94	8·06								
		350	4·83	34·11	27·01	8·06								
34	27	0	6·23	33·82	26·62	8·16	—	—	**N 50 V**	100–0	1325	—	—	TD 23 m.
		10	6·24	33·82	26·62	8·16	–	—	**N 70 V**	50–0				
		20	6·25	33·82	26·62	8·16	—	—	,,	100–50				
		30	6·27	33·83	26·62	8·16	—	—	,,	250–100				
		40	6·32	33·82	26·61	8·16	–	–	,,	480–250	–	1430		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. °Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
234 *cont.*	50° 53′ 50″ S, 56° 36′ 30″ W	29 v										
235	50° 45′ 00″ S, 56° 18′ 30″ W	29 v	1740	600 m. f. s. blk. spk.								
			2000	—	NW	2	NW	1	o.	1007·6	2·2	
236	50° 35′ 30″ S, 55° 59′ 15″ W	29–30 v	2155	612 m. f. s. blk. spk.								
			0000	—	N × W	3	N × W	2	o.	1010·1	3·3	
237	50° 17′ 40″ S, 55° 31′ 30″ W	30 v	0800	—	NW	4	NW	3	b. c.	1010·8	6·1	
			0840	904 m. f. s. blk. spk.								
			1200	—	NW	5	NW	4	o.	1011·8	4·4	
238	48° 12′ 00″ S, 51° 56′ 30″ W	31 v	2000	—	NW	5	NW	3	o.	1010·8	7·2	slight N swell
			0000	—	NW×W	5–7	NW	6	o. p.	1009·9	4·4	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
24		50	6·32	33·82	26·61	8·16	—	—	**N 100 H**	0–5	1443	1533	1	
t.		60	6·33	33·82	26·61	8·13	—	—	,,	73	,,	,,	1	
		80	6·33	33·86	26·63	8·13	—	—	,,	146	,,	,,	1	KT
		100	6·31	33·87	26·65	8·10	—	—	**N 70 H**	0–5	1549	1559	¼	
		150	6·15	33·91	26·68	8·10	—	—	,,	56	,,	,,	¼	
		200	5·88	33·98	26·78	8·10	—	—	,,	113	,,	,,	¼	KT
		300	5·12	34·04	26·92	8·07								
		400	4·83	34·07	26·98	8·05								
		480	4·88	34·18	27·06	8·05								
25	27	0	5·82	34·05	26·84	8·16	—	—	**N 50 V**	100–0	**1740**			
		10	5·81	34·05	26·84	8·16	—	—	**N 70 V**	50–0				
		20	5·83	34·05	26·84	8·16	—	—	,,	100–50				
		30	5·83	34·06	26·85	8·16	—	—	,,	250–100				
..		40	5·83	34·07	26·86	8·16	—	—	,,	500–250	—	**1850**		
		50	5·83	34·08	26·87	8·16	—	—	**N 100 H**	0–5	**1905**	**1941**	1	
		60	5·83	34·08	26·87	8·14	—	—	,,	70	,,	,,	1	
		80	5·84	34·08	26·86	8·12	—	—	,,	141	,,	,,	1	KT
		100	5·83	34·11	26·89	8·11	—	—	**N 70 H**	0–5	**1956**	**2009**	¼	
		150	5·31	34·14	26·98	8·10	—	—	,,	76	,,	,,	¼	
		200	4·93	34·16	27·04	8·10	—	—	,,	152	,,	,,	¼	KT
		300	4·90	34·20	27·07	8·08								
		400	4·22	34·23	27·18	8·08								
		580	4·01	34·23	27·20	8·06								
26	27	0	5·66	34·11	26·91	8·16	—	—	**N 50 V**	100–0	**2155**			
		10	5·66	34·11	26·91	8·16	—	—	**N 70 V**	50–0				
		20	5·69	34·12	26·91	8·16	—	—	,,	100–50				
		30	5·69	34·11	26·91	8·16	—	—	,,	250–100				
		40	5·63	34·11	26·91	8·16	—	—	,,	500–250	—	**2307**		
		50	5·56	34·13	26·93	8·16	—	—	**N 100 H**	0–5	**2322**	**2353**	1	
		60	5·55	34·12	26·93	8·16	—	—	,,	50	,,	,,	1	
		80	5·54	34·13	26·94	8·14	—	—	,,	100	,,	,,	1	KT
		100	5·53	34·12	26·93	8·12	—	—	**N 70 H**	0–5	**0010**	**0024**	¼	
		150	5·03	34·20	27·06	8·10	—	—	,,	46	,,	,,	¼	
		200	4·63	34·24	27·14	8·10	—	—	,,	92	,,	,,	¼	KT
		300	4·36	34·25	27·17	8·08								
		400	4·13	34·24	27·19	8·05								
		600	3·50	34·23	27·25	8·03								
27	28	0	5·66	34·14	26·94	8·14	—	—	**N 50 V**	100–0	0840	—	—	TD 21 m.
		10	5·64	34·13	26·92	8·14	—	—	**N 70 V**	50–0				
		20	5·64	34·13	26·92	8·14	—	—	,,	100–50				
		30	5·64	34·13	26·92	8·14	—	—	,,	250–100				
		40	5·64	34·13	26·92	8·14	—	—	,,	500–250				
		50	5·63	34·13	26·92	8·14	—	—	,,	750–500				
		60	5·62	34·13	26·93	8·14	—	—	,,	880–750	—	1040		
		80	5·62	34·13	26·93	8·14	—	—	**N 100 H**	0–5	1137	1212	1	
		100	5·54	34·13	26·94	8·14	—	—	,,	70	,,	,,	1	
		150	4·61	34·19	27·09	8·11	—	—	,,	140	,,	,,	1	KT
		200	4·50	34·23	27·14	8·10	—	—	**N 70 H**	0–5	1226	1240	¼	
		300	4·27	34·22	27·15	8·10	—	—	,,	85	,,	,,	¼	
		400	4·03	34·23	27·20	8·06	—	—	,,	170	,,	,,	¼	KT. ? not fishing properly
		500	3·82	34·23	27·22	8·04								
		700	3·20	34·25	27·29	8·01								
		850	2·81	34·30	27·37	7·98								
28	1	—	—	—	—	—	—	—	**N 100 H**	0–5	**2110**	**2140**	1	
									,,	74	**2108**	,,	1	
									,,	148	,,	,,	1	KT
									N 70 H	0–5	**2156**	**2212**	¼	
									,,	66	,,	,,	¼	
									,,	132	,,	,,	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
239	46° 56′ 00″ S, 46° 03′ 00″ W	2 vi	0800	—	NW	2	NW	2	c.	1010·4	10·6	
			1200	—	NW	2	NW	3	o.	1007·3	9·4	mod. NW swell
			1600	—	NW	2	NW	3	o.	1004·3	9·4	slight NW swell
240	46° 36′ 30″ S, 45° 07′ 00″ W	2 vi	2000	—	SSW	5	SSW	4	o. d.	1005·8	8·3	
			0000	—	SSW	6	SSW	5	o.	1005·0	7·8	
241	40° 34′ 30″ S, 36° 35′ 30″ W	5 vi	2000	—	SW	3	SW	2	b. c.	1026·0	8·9	heavy SW swell
			0000	—	W	3	SW	4	b. c.	1027·2	9·4	
242	39° 16′ 30″ S, 30° 26′ 00″ W	7 vi	2000	—	SW	4	SW	4	o. q. r.	1031·9	11·7	
			0000	—	SW	2–3	SW	2	b. c.	1033·3	11·7	
243	From 38° 48′ 00″ S, 27° 22′ 00″ W to 38° 46′ 00″ S, 27° 04′ 00″ W	8–9 vi	2000		SW	2	SW	1	o.	1031·9	13·9	slight SW swell
			0000	—	—	0–1	SW	2	b. c.	1031·2	15·0	,,
			0400	—	WNW	3	WNW	3	b. c.	1031·8	15·0	
244	38° 26′ 30″ S, 24° 48′ 30″ W	9 vi	2000	—	NW	4	NW	3	b. c.	1025·9	13·3	
			0000	—	NW	4	NW	3	b. c.	1024·5	12·8	
245	38° 20′ 00″ S, 22° 18′ 00″ W	10 vi	1200	—	WNW	4	WNW	3	b. c.	1022·1	14·4	
			1600	—	W	4	W	4	b. c. d.	1020·0	13·9	
246	38° 00′ 30″ S, 18° 27′ 00″ W	11 vi	2000	—	WNW	5	WNW	4	o.	1017·4	13·9	
			0000	—	WNW	6	WNW	5	o. p.	1016·0	14·4	
247	37° 20′ 00″ S, 12° 47′ 30″ W	13 vi	2000	—	N	5	N	4	b. c.	1024·3	14·4	
			0000	—	N × E	6	N	5	o.	1023·8	13·9	
248	37° 15′ 00″ S, 12° 20′ 00″ W	14 vi	2000	—	—	0–1	conf.	3	o.	1018·6	15·6	
			0000	—	NNE	7	NNE	4	o. d.	1017·6	16·1	
249	36° 19′ 30″ S, 8° 40′ 30″ W	16 vi	2000	—	—	0–1	—	0	b.	1014·0	14·4	conf. swell
			0000	—	SW	4	NW	2	b. c. r.	1015·7	15·0	mod. W swell

Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
	Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
3	0	10·08	34·42	26·50	—	—	—	**N 450**	1050–1350(–0)	1123	1323	4	DGB
								N 100 H	1050–1350	,,	,,	4	
3	—	—	—	—	—	—	—	**N 100 H**	0–5	**2126**	**2150**	1	
								,,	35	,,	,,	1	
								,,	70(–0)	,,	,,	1	KT
								N 70 H	0–5	**2212**	**2222**	¼	
								,,	40(–0)	**2213**	,,	¼	
								,,	80(–40)	,,	,,	¼	
6	—	—	—	—	—	—	—	**N 100 H**	0–5	**2117**	**2156**	1	
								,,	76	,,	,,	1	
								,,	152	,,	,,	1	KT
								N 70 H	0–5	**2217**	**2229**	¼	
								,,	49(–0)	,,	,,	¼	
								,,	98	,,	,,	¼	KT. Not fishing properly
8	—	—	—	—	—	—	—	**N 100 H**	0–5	**2114**	**2146**	1	
								,,	68	,,	,,	1	
								,,	137	,,	,,	1	KT
								N 70 H	0–5	**2212**	**2230**	¼	
								,,	62	,,	,,	¼	
								,,	124	,,	,,	¼	KT
								N 100 B / **N 70 B**	118–0	**2247**	**2308**	⅔	KT
9	0	14·70	35·16	26·19	at	2100	(time)	**N 70 H**	0–5	**2100**	**2100**	0·26	42 consecutive hauls (A–RR) of 10 mins. duration. Moon set 0130
	0	14·85	35·17	26·17	at	0030	,,			/	/		
	0	14·80	35·10	26·13	at	0400	,,	,,	0–5	**0350**	**0400**	0·26	
10	—	—	—	—	—	—	—	**N 100 H**	0–5	**2116**	**2142**	1	
								,,	55	,,	,,	1	
								,,	110(–0)	,,	,,	1	KT
								N 70 H	0–5	**2156**	**2207**	¼	
								,,	46	,,	,,	¼	
								,,	93	,,	,,	¼	KT
11	0	14·35	35·14	26·24	—	—	—	**N 450**	1800–2000	1225	1540	2·0	DGT
	1937	2·80	34·67	27·65									
12	—	—	—	—	—	—	—	**N 100 H**	0–5	**2114**	**2152**	1	
								,,	95	,,	,,	1	
								,,	190	,,	,,	1	KT
								N 70 H	0–5	**2209**	**2221**	¼	
								,,	77	,,	,,	¼	
								,,	154	,,	,,	¼	KT
14	—	—	—	—	—	—	—	**TYF**	100–115(–0)	**2110**	**2211**	1·9	KT
14	—	—	—	—	—	—	—	**TYF**	0–5	**2106**	**2224**	2·6	
								N 100 H	0–5	**2115**	**2146**	1	
								,,	95	,,	,,	1	
								,,	190	,,	,,	1	KT. Not fishing properly
								N 70 H	0–5	**2203**	**2215**	¼	
								,,	76	,,	,,	¼	
								,,	152	,,	,,	¼	KT
16	—	—	—	—	—	—	—	**N 100 H**	0–5	**2121**	**2150**	1	
								,,	60(–0)	,,	,,	1	
								,,	120(–60)	,,	,,	1	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
249 *cont.*	36° 19′ 30″ S, 8° 40′ 30″ W	1927 16 vi										
250	36° 09′ 00″ S, 5° 33′ 00″ W	17 vi	2000	-	SE × S	5	SE × S	4	b. c.	1029·9	14·4	
251	35° 54′ 30″ S, 3° 01′ 30″ W	18 vi	2000	—	SE	4	SE	3	o.	1034·0	12·8	mod. SSW swe
			0000	–	ESE	5	SE	3	o.	1033·3	12·2	
252	35° 26′ 00″ S, 1° 43′ 30″ E	20 vi	2000	—	SE	5	SE	4	b. c.	1024·5	12·8	mod. E swell
			0000	—	ESE	5	ESE	5	o.	1023·9	12·2	
253	35° 06′ 00″ S, 2° 19′ 00″ E	21 vi	1200	—	ESE	4	ESE	4	o.	1023·3	16·1	
254	35° 04′ 00″ S, 2° 59′ 30″ E	21 vi	2000	—	SE	3	SE	3	b. c. w.	1024·2	15·6	
255	34° 59′ 00″ S, 5° 31′ 00″ E	22 vi	2000	—	E	0–1	—	0	o.	1026·5	16·1	mod. SW swell
			0000	—	ESE	3	ESE	3	o.	1024·4	16·7	,,
256	35° 14′ 00″ S, 6° 49′ 00″ E	23 vi	1200	—	ENE	3	ENE	3	b. c.	1021·3	17·8	heavy SSW sw
257	35° 01′ 00″ S, 10° 18′ 00″ E	24 vi	2000	—	N × W	4	N × W	3	b. c.	1014·1	17·2	
			0000	—	N × W	4	N × W	3	o.	1012·4	16·7	
258	35° 03′ 30″ S, 13° 55′ 00″ E	25 vi	2000	—	SSW	4	SSW	4	b. c.	1023·0	15·0	heavy SW swel
			0000	—	SW	3	SW	3	b.	1024·0	16·1	mod. SW swell
259	34° 59′ 00″ S, 16° 39′ 00″ E	26 vi	2000	–	ENE	2	ENE	2	o.	1018·5	16·1	heavy SW swel
			0000		ENE	4	ENE	3	o.	1014·4	15·0	mod. SW swell
260	33° 06′ 30″ S, 17° 45′ 15″ E	19 vii	0800	—	S	4	S	2	b.	1020·5	15·0	mod. S swell
			1040	170 gn. m. s.								
			1200	—	S	0–1	—	0	b. c.	1021·6	15·0	,,

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	*σt*	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
19									**N 70 H**	0–5	**2210**	**2220**	¼	
t.									,,	61	,,	,,	¼	
									,,	122	,,	,,	¼	KT
20	17	—	—	—	—	—	—	—	**TYF**	300(–0)	**2043**	**2243**	3·6	DGB
21	18	—	—	—	—	—	—	—	**N 100 H**	0–5	**2116**	**2146**	1	
									,,	79	,,	,,	1	
									,,	159	,,	,,	1	KT
									N 70 H	0–5	**2205**	**2219**	¼	
									,,	70	,,	,,	¼	
									,,	140	,,	,,	¼	KT
22	20	—	—	—	—	—	—	—	**N 100 H**	0–5	**2105**	**2134**	1	
									,,	67	,,	,,	1	
									,,	135	,,	,,	1	KT
									N 70 H	0–5	**2150**	**2200**	¼	
									,,	76	,,	,,	¼	
									,,	152	,,	,,	¼	KT
23	21	0	16·20	35·10	25·80	—	—	+	**TYF**	1000–1050	1142	1342	4·1	DGB
24	21	—	—	—	—	—	—	+	**TYF**	200(–0)	**2039**	**2210**	3·5	
25	22	—	—	—	—	—	—	+	**N 100 H**	0–5	**2112**	**2147**	1	
									,,	87	,,	,,	1	
									,,	175	,,	,,	1	KT
									N 70 H	0–5	**2203**	**2214**	¼	
									,,	55	,,	,,	¼	
									,,	110	,,	,,	¼	KT
26	23	0	17·20	35·55	25·91	—	—	—	**TYF**	850–1100 (–0)	1135	1335	2·8	DGB
									,,	250(–0)	**2102**	**2235**	3·8	DGB
27	24	—	—	—	—	—	—	—	**N 100 H**	0–5	**2115**	**2145**	1	
									,,	55	,,	,,	1	
									,,	111	,,	,,	1	KT
									N 70 H	0–5	**2201**	**2214**	¼	
									,,	53	,,	,,	¼	
									,,	106	,,	,,	¼	KT
28	25	—	—	—	—	-	—	-	**TYF**	320–450	**2124**	**2255**	2·7	DGB
29	26	—	—	—	—	—	—	-	**TYF**	170–250(–0)	**2116**	**2240**	2·8	DGB. Specimens erroneously labelled 370–450(–0) m. KT
									N 100 H	0–5	**2129**	**2202**	1	
									,,	85	,,	,,	1	
									,,	170	,,	,,	1	
									N 70 H	0–5	**2218**	**2232**	¼	
									,,	90	,,	,,	¼	
									,,	180	,,	,,	¼	KT
30	20	0	13·97	35·12	26·30	8·34	—	—	**N 50 V**	100–0	1040	—	—	TD 17½ m.
		10	13·96	35·12	26·30	8·34	—	—	**N 70 V**	50–0				
		20	13·96	35·14	26·32	8·34	—	—	,,	100–50				
		30	13·96	35·12	26·30	8·34	—	—	,,	165–100	—	1110		
		40	13·95	35·12	26·30	8·34	—	—	**N 100 B**	104–0	1138	1158	⅔	KT
		50	13·39	35·07	26·38	8·32	—	—	**N 70 B**					
		60	12·59	34·99	26·48	8·25								
		80	11·40	34·94	26·67	8·20								
		100	9·52	34·76	26·84	8·01								
		130	8·53	34·67	26·95	7·89								
		168	8·40	34·60	26·92	7·85								

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
261	33° 06′ 30″ S, 17° 33′ 15″ E	1927 19 vii	1345	351 st.								
262	33° 06′ 30″ S, 17° 21′ 30″ E	19 vii	1600 1648	— 386 gn. m. blk. spk.	S	4	S	3	b. c.	1020·6	16·1	mod. S swell
263	33° 06′ 00″ S, 17° 08′ 00″ E	19 vii	2000	461	SE	3	SE	3	o.	1020·0	15·6	SSW swell
264	33° 06′ 00″ S, 16° 55′ 00″ E	19–20 vii	2330 0000	645 gl. oz. —	NE	2	NE	2	b. c.	1020·4	15·0	mod. SSW swell
265	33° 06′ 30″ S, 16° 32′ 00″ E	20 vii	0350 0400	1620 gl. oz. —	NNE	3	NNE	2	b. c.	1018·0	15·0	mod. S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
31	20	0	14·01	35·13	26·31	8·34	—	—	**N 50 V**	100–0	1345			
		10	13·89	35·13	26·32	8·34	—	—	**N 70 V**	50–0				
		20	13·81	35·13	26·34	8·34	—	—	,,	100–50				
		30	13·74	35·12	26·34	8·34	—	—	,,	250–100				
		40	13·69	35·14	26·37	8·34	—	—	,,	345–250	—	1425		
		50	13·65	35·12	26·36	8·34	—	—	**N 100 B**	88–0	1445	1505	2/3	KT
		60	13·01	35·07	26·46	8·28	—	—	**N 70 B**					
		80	11·40	34·96	26·68	8·21								
		100	10·87	34·90	26·74	8·13								
		150	10·12	34·87	26·85	8·06								
		200	8·23	34·69	27·01	8·00								
		270	7·55	34·58	27·03	8·01								
		350	6·04	34·47	27·15	8·01								
32	20	0	15·33	35·23	26·10	8·35	—	—	**N 50 V**	100–0	1648			
		10	15·31	35·23	26·10	8·35	—	—	**N 70 V**	50–0				
		20	15·30	35·25	26·11	8·35	—	—	,,	100–50				
		30	15·29	35·26	26·14	8·35	—	—	,,	250–100				
		40	15·25	35·28	26·15	8·35	—	—	,,	380–250	—	1725		
		50	15·24	35·26	26·15	8·35	—	—	**N 100 B**	90–0	1748	1808	2/3	KT
		60	15·13	35·25	26·15	8·33	—	—	**N 70 B**					
		80	13·31	35·04	26·37	8·26								
		100	11·90	34·92	26·56	8·21								
		150	10·91	34·81	26·67	8·15								
		200	9·92	34·74	26·76	8·15								
		300	8·23	34·54	26·91	8·00								
		380	6·90	34·43	27·01	7·98								
33	20	0	15·45	35·32	26·14	8·35	—	—	**N 50 V**	100–0	2002			
		10	15·44	35·30	26·13	8·35	—	—	**N 70 V**	50–0				
		20	15·44	35·30	26·13	8·35	—	—	,,	100–50				
		30	15·41	35·30	26·14	8·35	—	—	,,	250–100				
		40	15·30	35·28	26·14	8·35	—	—	,,	450–250	—	2042		
		50	15·29	35·30	26·17	8·35	—	—	**N 100 B**	104–0	2126	2146	2/3	KT
		60	15·23	35·30	26·18	8·35	—	—	**N 70 B**					
		80	15·19	35·28	26·17	8·32								
		100	13·39	35·07	26·39	8·29								
		150	11·58	34·92	26·62	8·20								
		200	10·60	34·81	26·72	8·15								
		300	8·61	34·60	26·91	8·02								
		375	7·91	34·52	26·93	8·02								
		450	6·14	34·40	27·08	7·98								
34	20	0	15·24	35·30	26·18	8·35	—	—	**N 50 V**	100–0	2330			
		10	15·23	35·30	26·18	8·35	—	—	**N 70 V**	50–0				
		20	15·23	35·28	26·16	8·35	—	—	,,	100–50				
		30	15·23	35·29	26·17	8·35	—	—	,,	250–100				
		40	15·22	35·29	26·17	8·35	—	—	,,	500–250				
		50	15·22	35·28	26·16	8·35	—	—	,,	640–500	—	0030		
		60	15·18	35·28	26·17	8·35	—	—	**N 100 B**	80–0	0059	0119	2/3	KT
		80	15·13	35·26	26·17	8·34	—	—	**N 70 B**					
		100	13·32	35·01	26·36	8·30								
		150	11·32	34·90	26·66	8·22								
		200	10·28	34·78	26·75	8·14								
		300	8·70	34·60	26·92	8·05								
		400	7·23	34·40	26·93	8·04								
		600	4·22	34·40	27·31	8·01								
35	21	0	15·31	35·28	26·14	8·35	—	—	**N 50 V**	100–0	0350			
		10	15·31	35·28	26·14	8·35	—	—	,,	50–0				
		20	15·31	35·29	26·15	8·35	—	—	,,	100–50				
		30	15·31	35·28	26·14	8·35	—	—	,,	250–100				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
265 *cont.*	33° 06′ 30″ S, 16° 32′ 00″ E	20 vii										
266	29° 34′ 00″ S, 14° 24′ 00″ E	21 vii	2000	—	NW×W	2	NW	1	b.	1021·8	16·1	slight S swell
			0000	—	NW×W	3	NW	2	b.	1022·8	17·2	
267	24° 31′ 00″ S, 12° 15′ 30″ E	23 vii	2000	—	S × W	5	S × W	5	b. c.	1021·3	15·6	heavy SW swell
			0000	—	SSW	6	SSW	5	o.	1022·0	16·1	,,
268	18° 37′ 00″ S, 10° 46′ 00″ E	25 vii	2000	—	SSE	6	SSE	5	b.	1021·7	14·4	mod. S swell
			0000	—	SSE	6	SSE	5	b.	1022·1	14·4	heavy S swell
269	15° 55′ 00″ S, 10° 35′ 00″ E	26 vii	2000	—	SSE	5	SSE	6	o.	1021·0	15·0	
270	13° 58′ 30″ S, 11° 43′ 30″ E	27 vii	2000	—	NNW	3	NNW	1	o.	1018·1	16·1	slight S swell
			0000	—	SW	3	SW	3	o.	1019·4	16·7	
271	Elephant Bay, Angola	28 vii	1200	—	—	0	—	0	o. h.	1017·3	20·0	
		29 vii	1600	—	S	4	—	0	b.	1015·3	17·2	
		30 vii	0800	—	—	0	—	0	o.	1018·6	17·2	
272	Off Elephant Bay, Angola. From 13° 11′ S, 12° 44′ 45″ E to 13° 09′ 45″ S, 12° 46′ E	30 vii	1120	73								
			1200	gn. s. m.	—	0	—	0	o.	1017·8	17·8	
			1308	91 gn. m. s.								
273	9° 38′ 00″ S, 12° 42′ 30″ E	31 vii	2000	—	—	0	—	0	b. c.	1018·2	21·7	
			0000	—	—	0	—	0	o.	1021·2	21·7	
274	Off St Paul de Loanda, Angola. From 8° 40′ 15″ S, 13° 13′ 45″ E to 8° 38′ 15″ S, 13° 13′ 00″ E	4 viii	1200	—	—	0	—	0	o.	1021·6	21·7	
			1310	64 gy. m.								
			1455	65 gy. m.								
			1600	—	W × S	2	—	0	b. h.	1014·1	21·7	
275	7° 51′ 00″ S, 12° 42′ 00″ E	4–5 viii	0000	—	W	3	—	0	b.	1017·1	22·8	
276	5° 54′ 00″ S, 11° 19′ 00″ E	5 viii	2000	—	—	0	—	0	b. c.	1015·0	21·7	slight SW swell
			0000	—	SW	3	SW	3	b.	1015·7	23·3	,,
277	1° 44′ 00″ S, 8° 38′ 00″ E	7 viii	2000	—	SW	4	SW	2	o.	1014·3	23·9	slight SW swell
			0000	—	SW	4	SW	3	o.	1014·8	23·3	
278	Off Port Gentil, French Congo, 8 miles N 37° E of C Lopez Lt	8 viii	2000	—	—	0–1	—	0	o.	1012·2	24·4	
279	Off C Lopez, French Congo. From 8·5 miles N 71° E to 15 miles N 24° E of C Lopez Lt	10 viii	1025	58 m. f. s.								
			1200	—	SW	3	SW	2	o.	1018·2	24·4	
			1310	67 m. f. s.								

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
25		40	15·30	35·28	26·14	8·35	—	—	**N 70 H**	500–250				
		50	15·31	35·29	26·15	8·35	—	—	,,	750–500				
		60	15·23	35·26	26·15	8·35	—	—	,,	1000–750				
		80	15·19	35·25	26·14	8·30	—	—	,,	1500–1000	—	0555		
		100	14·57	35·25	26·27	8·26	—	—	**N 100 B**	165–0	0610	0630	⅔	KT
		150	12·95	35·08	26·48	8·21	—	—	**N 70 B**					
		200	11·31	34·94	26·69	8·19								
		300	9·18	34·69	26·94	8·15								
		400	7·48	34·52	26·99	8·05								
		600	6·88	34·56	27·11	7·98								
		800	6·74	34·56	27·12	7·98								
		1000	5·37	34·42	27·19	7·98								
		1500	4·20	34·42	27·32	7·96								
26	22	—	—	—	—	—	—	—	**TYF**	200(–0)	2124	2224	1·5	DGB
									N 100 B	124–0	2131	2151	⅔	KT
									N 70 B					
27	24	—	—	—	—	—	—	—	**TYF**	450–550(–0)	2135	2235	1·7	DGB
									N 100 B	117–0	2142	2202	⅔	KT
									N 70 B					
28	26	—	—	—	—	—	—	—	**TYF**	100–150(–0)	2120	2220	2·3	DGB
									N 100 B	73–0	2128	2148	⅔	KT
29	27	—	—	—	—	—	—	—	**TYF**	600–700(–0)	1909	2109	3·6	DGB
30	28	—	—	—	—	—	—	—	**TYF**	200(–0)	2121	2221	1·0	
									N 100 B	126–0	2131	2151	⅔	KT
									N 70 B					
31	1–3	—	—	—	—	—	—	—	**TNL**	18	—	—	—	28–29 vii
									LH	18	—	—	—	28–30 vii
									NS	5–0	—	—	—	29 vii
									Sh. coll.	—	—	—	—	29–30 vii
32	3	0	17·00	35·39	25·83	—	—	—	**OTL**					
		90	14·40	35·17	26·28	—	—	—	**N 4–T**	73–91	1148	1248	2·0	
									NCS–T					
33	4	—	—	—	—	—	—	—	**TYF**	200–230(–0)	2044	2144	1·9	DGB
									N 100 B	118–0	2053	2113	⅔	KT
									N 70 B					
34	7	0	18·84	35·32	25·32	—	—	—	**OTL**					
		63	14·40	35·25	26·33	—	—	—	**N 7–T**	64–65	1330	1430	2	
									N 4–T					
									NCS–T					
35	7	—	—	—	—	—	—	—	**N 50 H**	0–2	0030	0035		
									N 70 H	,,				
36	8	—	—	—	—	—	—	—	**TYF**	150(–0)	2051	2151	2·1	DGB
									N 100 B	110–0	2101	2121	⅔	KT
									N 70 B					
37	10	—	—	—	—	—	—	—	**TYF**	63(–0)	2042	2142	2	KT
									N 100 B	88–0	2053	2108	½	KT
									N 70 B					
38	11	—	—	—	—	—	—	—	**N 70 H**	0–1	2000	2230	—	from anchored ship
39	13	0	24·60	33·08	22·22	—	—	—	**OTL**					
		66	14·94	35·34	26·27	—		—	**N 7–T**	58–67	1135	1250		
									N 4–T					
									NCS–T					
									N 70 H	0–5	1201	1211		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
280	00° 36′ 00″ S, 8° 28′ 00″ E	10 viii	2000	—	SSW	3	SSW	2	o.	1014·0	25·0	slight S swell
			0000	—	SSW	3	SSW	2	o.	1014·7	23·9	
281	00° 46′ 00″ S, 5° 49′ 15″ E	12 viii	1200	—	SSW	3	SSW	2	b. c.	1014·8	23·9	
			1600	—	SSW	2	SSW	2	b. c. h.	1011·8	23·9	
282	1° 11′ 00″ S, 5° 38′ 00″ E	12 viii	2000	—	S	1	—	0	b.	1014·6	24·4	
			0000	—	SSW	2	SSW	2	b.	1019·5	23·9	
283	Off Annobon, G of Guinea, 0·75 to 1 mile N 12° E of Pyramid Rk, Annobon	14 viii	1200	—	SSW	4	SSW	3	b.	1014·8	21·7	mod. SSW swell
284	2° 13′ 00″ S, 1° 52′ 00″ E	15 viii	2000	—	SSW	3	SSW	2	b.	1015·9	22·9	slight SSW swell
			0000	—	SW	3	SW	2	o.	1019·5	22·2	mod. SW swell
285	2° 43′ 30″ S, 00° 56′ 30″ W	16 viii	2000	—	SW	3	SW	2	b.	1017·2	23·3	
			0000	—	SW	4	SW	3	b.	1016·0	23·9	
286	3° 06′ 30″ S, 3° 53′ 00″ W	17 viii	2000	—	S	2	S	2	b.	1016·0	22·9	slight SSW swell
			0000	—	S × E	3	S × E	3	b.	1018·4	23·9	slight S swell
287	2° 49′ 30″ S, 9° 25′ 30″ W	19 viii	2000	—	ESE	3	ESE	1	b. c.	1019·0	22·8	mod. SE swell
			0000	—	ESE	3	ESE	2	o. r.	1018·0	21·1	,,
288	00° 56′ 00″ S, 14° 08′ 30″ W	21 viii	2000	—	SSE	4	SSE	2	b.	1016·3	23·3	
			0000	—	SSE	4	SSE	3	b. c.	1019·4	22·9	
289	3° 04′ 45″ N, 16° 52′ 00″ W	23–24 viii	2000	—	SSE	5	SSE	4	b. c.	1016·5	25·0	
			0000	—	SE	5	SE	4	b. c.	1017·6	24·4	
290	3° 25′ 25″ N, 16° 50′ 52″ W	24 viii	0400	—	SE	5	SE	4	o.	1015·2	24·4	
			0420	5165								
			0800	—	SE	4	SE	3	b. c.	1016·6	25·0	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
)	12	—	—	—	—	—	—	—	**TYF**	100–200(–0)	**2058**	**2158**	2	DGB
									N 100 B / **N 70 B**	84–0	**2107**	**2127**	⅔	KT
1	14	—	—	—	—	—	—	—	**N 70 H**	0	1345	1415	—	A
									TYF	850–950(–0)	1347	1517	4	DGB
									N 70 H	0	1520	1530	—	B
2	14	—	—	—	—	—	—	—	**TYF**	300(–0)	**2051**	**2151**	2·2	DGB
									N 100 B / **N 70 B**	157–0	**2059**	**2119**	⅔	KT
3	16	0	21·32	35·70	24·94	—	—	—	**DLH**	77	1000	1130		
		21	16·59	35·50	26·01	—	—	—	,,	18–30				
4	17	—	—	—	—	—	—	—	**N 100 B** / **N 70 B**	71–0	**2205**	**2225**	⅔	KT
5	18	—	—	—	—	—	—	-	**N 450**	125–175(–0)	**2042**	**2142**	2·9	DGB
6	19	—	—	—	—	—	—	—	**TYF**	125(–0)	**2049**	**2149**	1·8	DGB
									N 100 B / **N 70 B**	102–0	**2057**	**2117**	⅔	KT
7	22	—	—	—	—	—	—	—	**TYF**	800–1000 (–0)	**1852**	**2052**	3·4	DGB
									N 100 B / **N 70 B**	124–0	**2013**	**2033**	⅔	KT
									N 70 H	0	**2145**			
8	24	—	—	—	—	—	—	—	**TYF**	250(–0)	**1859**	**2125**	5·2	DGB
									N 100 B	73–0	**2014**	**2034**	⅔	KT
									N 70 B	100–0	**2058**	**2118**	⅔	KT
									N 100 H	0	**2100**	**2120**		
9	26	0	25·30	35·28	23·48	8·35	—	—	**N 50 V**	100–0	**2030**			
		20	25·30	35·29	23·49	8·35	—	—	**N 70 V**	50–0				
		40	25·30	35·28	23·48	8·35	—	—	,,	100–50				
		50	25·30	35·29	23·49	8·35	—	—	,,	250–100				
		65	25·21	35·30	23·63	8·35	—	—	,,	500–250				
		80	23·88	35·46	24·05	8·35	—	—	,,	750–500				
		90	19·72	35·71	25·40	8·24	—	—	,,	1000–750	—	0015		
		100	16·61	35·55	26·05	8·04	—	—	**NH**	0	**2320**	**2340**		
		150	14·28	35·39	26·45	8·02	—	—	**TYF**	125–225(–0)	**0042**	**0112**	1·1	DGB
		200	13·48	35·26	26·52	7·99	—	—	**N 100 B** / **N 70 B**	132–0	**0048**	**0108**	⅔	KT
		300	11·68	35·07	26·72	7·99	—	—						
		400	11·47	34·99	26·80	7·95								
		500	7·49	34·70	27·14	7·85								
		600	7·00	34·67	27·18	7·90								
		800	6·27	34·50	27·15	7·96								
		1000	4·68	34·50	27·33	7·96								
0	27	0	25·58	35·30	23·44	8·35	—	—	**N 50 V**	100–0	**0420**			
		20	25·58	35·30	23·44	8·35	—	—	**N 70 V**	50–0				
		40	25·58	35·30	23·44	8·35	—	—	,,	100–50				
		50	25·58	35·30	23·44	8·35	—	—	,,	250–100				
		65	25·54	35·30	23·44	8·35	—	—	,,	500–250				
		80	23·99	35·34	23·92	8·35	—	—	,,	750–500				
		85	21·62	35·44	24·68	8·32	—	—	,,	1000–750	—	0700		
		90	19·45	35·71	25·46	8·22	—	—	**TYF**	100(–0)	0729	0800	1·4	DGB
		100	17·00	35·54	25·95	8·04	—	—	**N 100 B** / **N 70 B**	86–0	0738	0758	⅔	KT
		150	14·37	35·37	26·42	8·01	—	—						
		200	13·56	35·21	26·56	7·99								
		300	11·72	35·16	26·78	7·95								
		400	8·96	34·78	26·98	7·82								
		500	7·34	34·59	27·06	7·82								
		600	6·20	34·52	27·17	7·92								
		800	5·29	34·49	27·26	7·90								
		1000	4·60	34·49	27·33	7·98								

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
291	3° 46′ 00″ N, 16° 49′ 00″ W	24 viii	1020	6040								
			1200	—	SE	5	SE	5	b. c.	1017·2	25·6	
292	4° 03′ 15″ N, 16° 51′ 00″ W	24 viii	1444	5700								
			1600	—	SE	5	SE	6	b. c.	1016·4	25·6	
293	4° 18′ 15″ N, 16° 51′ 00″ W	24 viii	2000	—	SE	5	SE	4	b. c.	1016·4	25·0	
			0000	—	SE	4	SE	4	b. c.	1019·8	25·0	
294	4° 33′ 15″ N, 16° 52′ 45″ W	25 viii	0400	—	S × E	4	S × E	4	b. c.	1015·6	23·9	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
21	27	0	25·68	35·34	23·42	8·36	—	—	**N 50 V**	100–0	1020			
		20	25·68	35·34	23·42	8·36	—	—	**N 70 V**	50–0				
		40	25·68	35·34	23·42	8·36	—	—	,,	100–50				
		60	25·21	35·34	23·56	8·36	—	—	,,	250–100				
		80	22·01	35·68	24·75	8·33	—	—	,,	500–250				
		90	19·22	35·74	25·54	8·20	—	—	,,	750–500				
		100	16·70	35·52	26·00	8·04	—	—	,,	1000–750	—	1159		
		150	14·18	35·32	26·41	7·97	—	—	**TYF**	100(–0)	1225	1255	1·2	DGB
		200	13·57	35·14	26·40	7·97	—	—	**N 100 B**	113–0	1232	1252	⅔	KT
		300	11·51	35·05	26·73	7·86	—	—	**N 70 B**					
		400	9·55	34·81	26·91	7·82								
		500	8·93	34·79	26·99	7·84								
		600	7·65	34·63	27·06	7·84								
		800	6·08	34·51	27·18	7·84								
		1000	5·11	34·51	27·30	7·86								
22	27	0	25·93	35·46	23·44	8·35	—	—	**N 50 V**	100–0	1444			
		20	25·93	35·46	23·44	8·35	—	—	**N 70 V**	50–0				
		40	25·93	35·46	23·44	8·35	—	—	,,	100–50				
		60	25·93	35·46	23·44	8·35	—	—	,,	250–100				
		70	25·82	35·50	23·50	8·35	—	—	,,	500–250				
		75	24·58	35·50	23·93	8·34	—	—	,,	750–500				
		78	24·08	35·52	24·09	8·32	—	—	,,	1000–750	—	1647		
		85	23·68	35·73	24·31	8·32	—	—	**TYF**	100–180(–0)	1713	1743	1	DGB
		90	20·22	35·82	25·35	8·14	—	—	**N 100 B**	110–0	1721	1741	⅔	KT
		100	15·98	35·70	26·31	7·97	—	—	**N 70 B**					
		150	14·18	35·53	26·58	7·96								
		200	13·40	35·41	26·65	7·96								
		300	12·07	35·32	26·84	7·84								
		400	9·20	35·05	27·14	7·78								
		500	8·40	34·89	27·15	7·78								
		600	6·96	34·79	27·20	7·80								
		800	5·39	34·67	27·39	7·81								
		1000	4·64	34·67	27·47	7·82								
23	27	0	26·01	35·46	23·44	8·36	—	—	**N 50 V**	100–0	**1940**			
		20	26·01	35·46	23·44	8·36	—	—	**N 70 V**	50–0				
		40	26·04	35·46	23·43	8·36	—	—	,,	100–50				
		60	26·13	35·48	23·41	8·36	—	—	,,	250–100				
		70	25·76	35·59	23·55	8·36	—	—	,,	500–250				
		75	23·73	35·71	24·38	8·34	—	—	,,	750–500				
		80	21·55	35·77	24·94	8·13	-	-	,,	1000–750				
		90	16·69	35·61	26·18	7·97	—	—	,,	1000–0	—	**2210**		
		100	15·44	35·52	26·19	7·96	—	—	**TYF**	100–120(–0)	**2225**	**2258**	0·9	DGB
		150	14·18	35·41	26·48	7·96	—	—	**N 100 B**	84–0	**2235**	**2255**	⅔	KT
		200	13·28	35·32	26·59	7·96	—	—	**N 70 B**					
		300	11·61	35·16	26·79	7·90								
		400	9·63	34·92	26·94	7·80								
		500	7·10	34·74	27·23	7·78								
		600	6·30	34·58	27·20	7·81								
		800	5·48	34·58	27·32	7·81								
		1000	4·67	34·60	27·42	7·86								
24	27	0	26·30	35·48	23·36	8·38	—	—	**N 50 V**	100–0	**0100**			
		20	26·30	35·48	23·36	8·38	—	—	**N 70 V**	50–0				
		40	26·30	35·48	23·36	8·38	—	—	,,	100–50				
		60	26·20	35·51	23·41	8·38	—	—	,,	250–100				
		80	23·54	35·71	24·33	8·36	—	—	,,	500–250				
		85	20·32	35·68	25·20	8·20	—	—	,,	750–500	—	**0310**		
		90	18·61	35·70	25·68	8·10	—	—	**NH**	0	**0300**			
		100	16·04	35·52	26·05	7·97	—	—	**TYF**	100–150(–0)	**0335**	**0407**	1·0	DGB

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
294 *cont.*	4° 33′ 15″ N, 16° 52′ 45″ W	1927 25 viii										
295	5° 30′ 30″ N, 17° 45′ 00″ W	25 viii	1200	—	SE	5	SE	5	b. c.	1020·1	26·1	
			1600	—	SE	5	SE	5	b. c.	1015·7	26·1	
296	8° 12′ 00″ N, 18° 49′ 00″ W	26 viii	2000	—	SSW	4	SSW	4	b. c.	1015·2	25·0	
297	12° 08′ 00″ N, 20° 53′ 30″ W	28 viii	2000	—	W	2	W	1	b. c.	1016·2	26·1	mod. SSW sw
298	13° 01′ 45″ N, 21° 34′ 45″ W	29 viii	1200	—	WNW	2	WNW	1	o.	1013·0	28·3	
299	Tarrafal, S Antonio, Cape Verde Is	4 ix	1200	—	—	0–1	—	0	b.	1014·1	28·9	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
24		150	14·26	35·44	26·49	7·95	—	—	**N 100 B**	101–0	**0345**	**0405**	⅔	KT
		200	13·30	35·28	26·56	7·96	—	—	**N 70 B**					
		300	11·99	35·19	26·73	7·83								
		400	9·08	34·88	27·03	7·75								
		500	7·88	34·78	27·15	7·70								
		600	6·66	34·69	27·23	7·76								
		800	5·32	34·54	27·30	7·76								
		1000	4·61	34·63	27·45	7·94								
25	27	2598	2·85	34·88	27·83	—	—	—	**TYF**	2500–2700 (–0)	1253	1553	5·8	DGT
26	28	—	—	—	—	—	—	—	**TYF**	450–500(–0)	**1833**	**2040**	4·6	DGB
									N 100 B	120–0	**2016**	**2036**	⅔	KT
									N 70 B					
27	2	—	—	—	—	—	—	—	**TYF**	200–300(–0)	**1851**	**2051**	3·7	DGB
									N 100 B	163–0	**2009**	**2029**	⅔	KT
									N 70 B					
28	3	—	—	—	—	—	—	—	**TYF**	900–1200 (–0)	1142	1255	2·1	DGB
29	8	0	25·22	36·36	24·33	—	—	+	**NRM**	7–11	1000	—	—	two short hauls
									N 70 H	0	1000			
									NH	0				
									LH	7				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 1	31° 52′ 00″ S, 17° 47′ 00″ E	1926 25 viii	1930	—	SW	3	S	4	b.	1031·0	12·2	
WS 2	22° 24′ 00″ S, 13° 25′ 00″ E	13 ix	2032	—	SSW	2	SSW	1–2	c.	1015·5	13·3	heavy SSW sw
WS 3	27° 50′ 00″ S, 15° 12′ 00″ E	17 ix	1918	—	SSE	4	SSE	4	b.	1021·2	12·8	heavy S swell
WS 4	32° 45′ 00″ S, 18° 10′ 00″ E	30 ix	1838	46	SSW	3	SSW	3	b.	1021·3	15·0	heavy SW sw
WS 5	35° 08′ 00″ S, 13° 46′ 00″ E	22 x	2100	—	var.	1–2	SE	5	o.	1011·4	15·0	heavy conf. sw
WS 6	35° 28′ 00″ S, 12° 12′ 00″ E	23 x	0900	—	ESE	5	ESE	5	o. r.	1011·2	15·9	heavy SE swe
WS 7	36° 39′ 00″ S, 10° 34′ 00″ E	23 x	2100	—	ESE	3	ESE	2	r.	1012·7	12·8	heavy ESE sw
WS 8	40° 36′ 00″ S, 5° 11′ 00″ E	25 x	0900	—	WNW	4	WNW	2	b. c.	1003·3	8·9	heavy SE swe
WS 9	41° 32′ 00″ S, 3° 41′ 00″ E	25 x	2100	—	SW	3	WNW	2–3	d. m.	1003·3	8·0	heavy SW swe
WS 10	44° 59′ 00″ S, 2° 44′ 00″ W	27 x	0905	—	WNW	4	WNW	3	b. c.	998·4	4·4	heavy W swel
WS 11	43° 53′ 00″ S, 4° 30′ 00″ W	27 x	2100	—	WSW	6–7	WSW	6	o. h. q.	1002·6	1·7	heavy W swel
WS 12	48° 00′ 00″ S, 10° 27′ 00″ W	30 x	0915	—	WSW	7	WSW	7	o. q.	1012·1	0·6	v. heavy SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	*σt*	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 1	17	0	12·59	34·92	26·51	—	46	—	**N 100 H**	37	**1930**	**2000**	1	
WS 2	6	0	13·29	35·01	26·37	—	95	—	**N 100 H**	62	**2032**	**2052**	1	KT
WS 3	10	0	12·19	34·81	26·43	—	75	—	**N 100 H**	73	**1918**	**1939**	1	KT
WS 4	24	—	—	—	—	—	—	—	**DL**	45–47	**1838**	**1855**	1	
WS 5	16	0	13·6	—	—	—	—	—	**N 100 H**	0–5	**2130**	**2200**	1	
									,,	50	**2125**	**2155**	1	
									,,	100	**2115**	**2155**	1⅓	
									N 70 H	0–5	**2300**	**2317**	⅔	
									,,	50	**2310**	**2317**	¼	
									,,	100	**2320**	**2337**	⅔	
WS 6	17	0	13·78	35·25	26·44	—	—	—	**N 100 H**	0–5	0915	0945	1	
									,,	50	,,	,,	1	
									,,	100	,,	,,	1	
									N 70 H	0–5	1035	1043	¼	
									,,	50	1011	1025	⅔	
									,,	100	1011	1030	⅔	
WS 7	17	0	13·19	35·08	26·43	—	—	—	**N 100 H**	0–5	**2134**	**2220**	1⅗	
									,,	55(–0)	**2132**	**2202**	1	
									,,	110(–55)	**2110**	**2202**	1⅗	KT
									N 70 H	0	**2132**	**2140**	¼	
									,,	50	**2135**	**2143**	¼	
									,,	100	**2125**	**2143**	½	
WS 8	19	0	9·30	34·29	26·53	—	—	—	**N 100 H**	0–5	0913	0944	1	
									,,	87	0911	0943	1	
									,,	174	0905	0943	1¼	KT
									N 70 H	0–5	1002	1011	¼	
									,,	87	1010	1018	¼	
									,,	174	1004	1018	½	
WS 9	19	0	7·95	34·29	26·74	—	—	—	**N 100 H**	0–5	**2114**	**2144**	1	
									,,	87	,,	,,	1	
									,,	174	**2105**	,,	1⅓	KT
									N 70 H	0–5	**2209**	**2217**	¼	
									,,	87	,,	,,	¼	
									,,	174	**2200**	,,	½	
WS 10	21	0	4·94	34·14	27·03	—	—	—	**N 100 H**	0–5	0915	0945	1	
									,,	50(–0)	0912	0942	1	
									,,	100	0907	0942	1¼	
									N 70 H	0	1017	1023	¼	
									,,	57	1022	1029	¼	
									,,	115	1016	1029	½	KT
WS 11	21	0	3·68	34·03	27·07	—	—	—	**N 100 H**	0–5	**2110**	**2140**	1	
									,,	50	**2115**	**2145**	1	
									,,	100	**2107**	**2148**	1¼	
									N 70 H	0–5	**2155**	**2203**	¼	
									,,	50	**2214**	**2222**	¼	
									,,	100	**2208**	**2222**	½	
WS 12	24	0	1·7	33·87	27·11	—	—	—	**N 100 H**	0–5	0925	0955	1	
									,,	82	0936	1006	1	
									,,	164	0922	1006	1½	KT
									N 70 H	0–5	1001	1009	¼	
									,,	104	1055	1106	¼	KT
									,,	165	1027	1035	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 13	50° 12′ 00″ S, 15° 13′ 00″ W	1926 1 xi	0940	—	WNW	4	WNW	4	o. m. d.	1012·4	2·5	heavy W swe
WS 14	50° 55′ 00″ S, 17° 49′ 00″ W	1 xi	2100	—	WNW	5–6	WNW	5	o.	1007·4	3·1	heavy W swe
WS 15	52° 40′ 00″ S, 23° 52′ 00″ W	3 xi	0905	—	NNE	2–3	NNE	2	c.	1007·1	− 0·8	slight S swell
WS 16	52° 56′ 00″ S, 26° 17′ 00″ W	3 xi	2100	—	W × S	6–7	W × S	6	o. p. r. s.	996·0	0·6	mod. conf. sw
WS 17	53° 57′ 00″ S, 33° 23′ 00″ W	5 xi	2120	—	W	2–3	W	2	o.	1013·7	− 1·1	mod. W swel
WS 18	54° 07′ 00″ S, 36° 23′ 00″ W	26 xi	1700	113 gy. m.	NNW	6–7	NNW	6–7	r. rs. o.	1007·1	1·7	mod. conf. sw
WS 19	54° 00′ 30″ S, 36° 20′ 30″ W	27 xi	1035	128 r.	NNW	6	NNW	6	o. r.	1004·2	2·78	mod. NW sw
WS 20	53° 52′ 30″ S, 36° 00′ 00″ W	28 xi	0830	535 r.	N	5	N	5	o. m. r.	996·6	1·7	heavy NNW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
W 13	26	0	1·25	33·87	27·14	—	—	—	**N 100 H**	0–5	0945	1015	1	
									,,	50	0953	1023	1	
									,,	100	0944	1023	1⅓	
									N 70 H	0–5	1020	1028	¼	
									,,	50	1046	1054	¼	
									,,	100	1040	1054	½	
WS 14	26	0	1·9	33·87	27·10	—	—	—	**N 100 H**	0–5	**2113**	**2143**	1	
									,,	50	**2122**	**2152**	1	
									,,	100	**2115**	**2152**	1¼	
									N 70 H	0–5	**2147**	**2155**	¼	
									,,	50	**2217**	**2225**	¼	
									,,	100	**2211**	**2225**	½	
WS 15	28	0	0·8	33·91	27·20	—	—	—	**N 100 H**	0–5	0913	0943	1	
									,,	81	0917	0947	1	KT
									,,	183	0910	,,	1¼	KT
									N 70 H	0–5	0949	0957	¼	
									,,	91	1011	1019	¼	KT
									,,	200	1004	1019	½	KT
WS 16	28	0	− 0·3	33·82	27·19	—	—	—	**N 100 H**	0–5	**2107**	**2137**	1	
									,,	90	**2152**	**2122**	1	
									,,	183	**2109**	**2139**	1	KT
									N 70 H	0	**2152**	**2200**	¼	
									,,	190	**2136**	**2144**	¼	KT
WS 17	1	0	− 0·7	33·85	27·22	—	—	—	**N 100 H**	0–5	**2128**	**2158**	1	
									,,	101	**2213**	**2243**	1	KT
									,,	174	**2125**	**2155**	1	KT
									N 70 H	0–5	**2209**	**2217**	¼	
									,,	101	**2313**	**2321**	¼	KT
									,,	200	**2254**	**2302**	¼	KT
WS 18	21	0	0·2	33·74	27·10	—	88	—	**N 70 V**	50–0	1710			
		5	0·2	33·74	27·10	—	93	—	,,	100–0	—	1730		
		10	0·2	33·73	27·09	—	98	—	**N 100 H**	0–5	1912	1942	1	
		20	0·1	33·74	27·10	—	108	—	,,	49	1920	1950	1	KT
		30	0·35	33·81	27·15	—	113	—	,,	118	1905	1950	1½	KT
		40	− 0·4	33·86	27·22	—	118	—	**N 70 H**	0–5	1944	1952	¼	
		50	− 0·6	33·89	27·25	—	123	—	,,	46	**2015**	**2023**	¼	KT
		75	− 0·75	33·91	27·28	—	117	—	,,	128	**2008**	**2023**	½	KT
		100	− 0·9	33·93	27·30	—	119							
WS 19	22	0	0·2	33·83	27·17	—	97	—	**N 70 V**	50–0	1025			
		5	0·2	33·83	27·17	—	125?	—	,,	100–0	—	1100		
		10	0·2	33·83	27·17	—	111	—	**N 100 H**	0–5	1330	1400	1	
		20	0·2	33·83	27·17	—	106	—	,,	77	1333	1403	1	KT
		30	0·1	33·83	27·18	—	105	—	,,	164	1326	1403	1¼	KT
		40	0·1	33·83	27·18	—	108	—	**N 70 H**	0–5	1426	1434	¼	
		50	0·1	33·86	27·19	—	111	—	,,	62	1431	1439	¼	KT
		75	− 0·6	33·88	27·25	—	125	—	,,	155	1425	1439	½	KT
		100	− 0·9	33·92	27·29	—	130							
WS 20	23	0	0·45	33·82	27·15	—	89	—	**N 70 V**	50–0	0830			
		5	0·45	33·83	27·16	—	93	—	,,	100–50				
		10	0·4	33·83	27·16	—	93	—	,,	250–100				
		20	0·35	33·83	27·16	—	100	—	,,	500–250		0915		
		30	0·3	33·83	27·17	—	103	—	**N 100 H**	0–5	1035	1105	1	
		40	0·3	33·83	27·17	—	101		,,	86	1102	1132	1	KT
		50	0·3	33·84	27·17	—	101		,,	190	1054	1132	1¼	KT
		75	0·25	33·87	27·20	—	101		**N 70 H**	0–5	1230	1238	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 20 *cont.*	53° 52′ 30″ S, 36° 00′ 00″ W	1926 28 xi										
WS 21	53° 45′ 30″ S, 35° 48′ 00″ W	28 xi	1400	899 g.	NNW	3	NNW	3	o. m. r.	993·0	1·67	mod. NW sw
WS 22	53° 38′ 00″ S, 35° 35′ 00″ W	30 xi	1415	2260	NNE	1–2	NNE	0–1	o. m. r. h. s.	991·8	1·1	slight conf. sw
WS 23	Government Jetty, Grytviken, S Georgia	7 xii	1500	—	E	2	—	0	b. c.	984·9	4·44	
WS 24	54° 12′ 07″ S, 36° 28′ 07″ W	10 xii	1530	172 gn. m. 212 gn. m.	—	0–1	—	0	o.	996·7	2·2	slight NE sw
WS 25	Undine Harbour (North), S Georgia	17 xii	2030	18 m. s.	var.	1	—	0	o.	997·2	1·39	
WS 26	53° 33′ 15″ S, 37° 45′ 15″ W	18 xii	1800	1180 gy. m.	E × N	3	E	2	o.	1002·9	1·39	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
W 20		100	− 0·1	33·89	27·23	—	105	—	**N 70 H**	71	1203	1211	¼	KT
st.		150	− 0·55	33·96	27·31	—	133	—	,,	164	1155	1211	½	KT
		200	0·3	34·14	27·42	—	125							
		300	1·6	34·40	27·54	—	129							
		400	1·85	34·49	27·59	—	118							
		500	1·89	34·49	27·59	—	120							
V 21	23	0	0·2	33·86	27·19	—	106	—	**N 70 V**	50–0	1400			
		5	0·2	33·86	27·19	—	109	—	,,	100–50				
		10	0·1	33·86	27·19	—	123	—	,,	250–100				
		20	0·1	33·86	27·19	—	118	—	,,	500–250				
		30	0·05	33·86	27·20	—	113	—	,,	750–500	—	1600		
		40	0·05	33·86	27·20	—	119	—	**N 100 H**	0–5	1635	1706	1	
		50	0·00	33·86	27·20	—	125	—	,,	95	1646	1716	1	KT
		75	− 0·4	33·87	27·24	—	120	—	,,	192	1634	1716	1¼	KT
		100	− 0·9	33·93	27·30	—	120	—	**N 70 H**	0–5	1710	1718	¼	
		150	− 0·2	34·07	27·39	—	126	—	,,	90	1743	1750	¼	KT
		200	1·4	34·33	27·49	—	129	—	,,	192	1735	1750	½	KT
		300	1·95	34·51	27·60	—	134							
		400	2·0	34·58	27·66	—	144							
		500	2·04	34·61	27·69	—	142							
		750	1·86	34·69	27·75	—	152							
V 22	25	0	0·1	33·86	27·19	—	123	—	**N 70 V**	50–0	1415			
		5	0·1	33·86	27·19	—	123	—	,,	100–50				
		10	0·1	33·86	27·19	—	123	—	,,	250–100				
		20	0·00	33·86	27·20	—	123	—	,,	500–250				
		30	0·05	33·86	27·20	—	123	—	,,	750–500				
		40	− 0·1	33·86	27·20	—	125	—	,,	1000–750	—	1850		
		50	− 0·1	33·86	27·20	—	125	—	**N 100 H**	0–5	1909	1939	1	
		75	− 0·15	33·87	27·23	—	132	—	,,	82	1910	1946	1¼	KT
		100	− 0·65	33·93	27·29	—	133	—	,,	185	1903	1946	1¼	KT
		150	− 0·3	34·04	27·36	—	145	—	**N 70 H**	0–5	**2009**	**2017**	¼	
		200	0·6	34·25	27·48	—	132	—	,,	71	**2014**	**2022**	¼	KT
		300	1·9	34·51	27·61	—	144	—	,,	165	**2007**	**2022**	½	KT
		400	2·2	34·58	27·64	—	152							
		500	1·94	34·61	27·69	—	148							
		750	1·82	34·69	27·75	—	149							
		1000	1·14	34·70	27·82	—	145							
W 23	3	0	2·25	30·77	24·59	—	—	—	**NH**	0–1				
									N 50 H	0–1	1515	1545	—	net streamed by current
W 24	6	0	1·92	33·49	26·79	—	101	—	**N 70 V**	50–0	1530			
		5	1·60	33·73	27·00	—	114	—	,,	100–50				
		10	0·94	33·73	27·04	—	114	—	,,	160–100				
		20	0·85	33·75	27·07	—	130	—	,,	200–100	—	1600		
		30	0·64	33·77	27·09	—	133	—	**N 100 H**	0–5	1651	1722	1	
		40	0·60	33·79	27·12	—	125	—	,,	68	,,	1721	1	
		50	0·33	33·80	27·14	—	132	—	,,	137	,,	,,	1	KT
		75	0·12	33·83	27·18	—	136	—	**N 70 H**	0–5	1746	1754	¼	
		100	0·05	33·85	27·19	—	144	—	,,	58	,,	,,	¼	
		150	− 0·65	33·87	27·25	—	144	—	,,	117	,,	,,	½	KT
		200	− 0·97	34·12	27·45	—	151							
W 25	13	—	—	—	—	—	—	—	**BTS**	18–27	**2030**	**2115**		
W 26	14	0	1·70	33·82	27·07	—	106	7·40	**N 70 V**	50–0	1800			
		5	1·75	33·82	27·07	—	106	7·34	,,	100–50				
		10	1·70	33·82	27·07	—	105	8·08?	,,	250–100				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 26 *cont.*	53° 33′ 15″ S, 37° 45′ 15″ W	1926 18 xii										
WS 27	53° 55′ 00″ S, 38° 01′ 00″ W	19 xii	0600	80 g.	ENE	2	ENE	1	o. s.	1006·5	0·83	
WS 28	53° 48′ 15″ S, 38° 13′ 00″ W	19 xii	1000	346 gy. m. 150 gy. m.	NE × E	2–3	ENE	1	o. s.	1007·5	1·39	
WS 29	53° 41′ 15″ S, 38° 24′ 45″ W	19 xii	1350	614	ENE	2	ENE	1	o. s.	1007·9	1·67	
WS 30	53° 34′ 15″ S, 38° 36′ 15″ W	19–20 xii	1835	2582	ENE	2–1	—	0	c.	1009·9	1·67	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 26 *at.*		20	1·65	33·82	27·07	—	109	7·50	**N 70 V**	500–250				
		30	1·00	33·82	27·12	—	115	7·58	,,	750–500				
		40	0·63	33·82	27·14	—	120	7·46	,,	1000–750	—	**2215**		
		50	0·40	33·84	27·17	—	125	7·53	**N 100 H**	0–5	**2240**	**2311**	1	
		75	− 0·45	33·87	27·24	—	130	7·31	,,	96	,,	,,	1	
		100	− 0·60	33·91	27·27	—	134	7·31	,,	192	,,	,,	1	KT
		150	− 0·55	34·00	27·34	—	145	6·66	**N 70 H**	0–5	**0003**	**0010**	¼	
		200	0·35	34·18	27·45	—	152	5·79	,,	70	,,	,,	¼	
		300	1·65	34·42	27·54	—	156	4·41	,,	141(–70)	,,	,,	¼	KT
		400	1·95	34·49	27·58	—	160	4·04						
		500	2·48	34·57	27·61	—	156	3·86						
		750	1·95	34·63	27·70	—	149	3·93						
		1000	1·87	34·67	27·74	—	147	3·84						
WS 27	15	0	1·00	33·82	27·12	—	99	—	**N 50 V**	70–0	0600			
		10	0·88	33·84	27·14	—	98	—	**N 70 V**	50–0				
		20	0·65	33·86	27·16	—	96	—	,,	75–50	—	0700		
		30	0·50	33·86	27·17	—	103	—	**N 100 H**	0–5	0745	0815	1	
		40	0·50	33·86	27·17	—	104	—	,,	53	,,	,,	1	
		50	0·50	33·87	27·19	—	110	—	,,	107	,,	,,	1	KT. Net touched bottom
		60	0·45	33·87	27·19	—	110	—	**N 70 H**	0–5	0842	0850	¼	
		70	0·45	33·87	27·19	—	111	—	,,	104	,,	,,	¼	KT
WS 28	15	0	1·35	33·78	27·07	—	99	7·39	**N 50 V**	100–0	1000	—	—	near large iceberg
		10	1·45	33·80	27·07	—	103	7·41	**N 70 V**	50–0				
		20	0·95	33·84	27·13	—	105	7·59	,,	100–50				
		30	0·70	33·84	27·15	—	106	7·42	,,	145–100	—	1100		
		40	− 0·15	33·91	27·26	—	111	7·40	**N 100 H**	0–5	1119	1149	1	
		50	− 0·35	33·91	27·26	—	125	7·42	,,	80	,,	,,	1	KT
		60	− 0·65	33·95	27·31	—	125	7·10	**N 70 H**	0–5	1202	1210	¼	
		80	− 0·70	33·95	27·31	—	130	7·14	,,	88	,,	,,	¼	KT
		100	− 0·75	33·95	27·31	—	133	7·12						
		135	− 0·75	33·96	27·32	—	134	7·02						
WS 29	15	0	1·85	33·80	27·04	—	104	—	**N 50 V**	100–0	1315			
		10	1·75	33·78	27·04	—	—	—	**N 70 V**	50–0				
		20	1·70	33·80	27·05	—	105	—	,,	100–50				
		30	1·55	33·80	27·06	—	100	—	,,	250–100				
		40	0·75	33·80	27·11	—	113	—	,,	500–250				
		50	0·15	33·87	27·21	—	116	—	,,	600–500	—	1520		
		60	- 0·20	33·89	27·24	—	124	—	**N 100 H**	0–5	1602	1632	1	
		80	0·45	33·95	27·30	—	132	—	,,	59	,,	,,	1	
		100	− 0·60	33·96	27·31	—	142	—	,,	118	,,	,,	1	KT
		150	0·35	34·22	27·47	—	154	—	**N 70 H**	0–5	1700	1708	¼	
		200	0·90	34·33	27·53	—	164	—	,,	66	,,	,,	¼	
		300	1·75	34·47	27·59	—	162	—	,,	132(–66)	,,	,,	¼	KT
		400	1·95	34·55	27·64	—	184							
		500	2·02	34·56	27·64	—	174							
		600	2·11	34·65	27·70	—	169							
WS 30	15	0	1·80	33·82	27·06	—	78	7·82	**N 50 V**	100–0	1835			
		10	1·80	33·83	27·07	—	78	7·85	**N 70 V**	50–0				
		20	1·50	33·86	27·11	—	79	—	,,	100–50				
		30	1·10	33·86	27·13	—	88	7·75	,,	250–100				
		40	0·90	33·85	27·14	—	93	7·50	,,	500–250				
		50	0·90	33·86	27·15	—	100	7·48	,,	750–500				
		60	0·75	33·87	27·18	—	100	7·80	,,	1000–750	—	**2215**		
		80	0·40	33·91	27·27	—	108	7·55	**N 100 H**	0–5	**2258**	**2328**	1	
		100	- 0·70	34·95	27·31	—	115	7·69	,,	67	,,	,,	1	
		150	0·30	34·09	27·40	—	114	6·48	,,	134(–67)	,,	,,	1	KT
		200	1·25	34·35	27·53	—	123	4·94	**N 70 H**	0–5	**0012**	**0019**	¼	
		300	1·85	34·51	27·61	—	126	4·43	,,	50	,,	,,	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 30 *cont.*	53° 34′ 15″ S, 38° 36′ 15″ W	1926 19–20 xii										
WS 31	54° 52′ 00″ S, 35° 36′ 00″ W	20 xii	1600	76 st. r.	var.	1	—	0	c.	1002·2	4·41	
WS 32	Mouth of Drygalski Fjord, S Georgia	21 xii	1220	225 gy. m.	SSE	6–3	—	0	b. c.	994·1	7·5	
WS 33	54° 59′ 00″ S, 35° 24′ 00″ W	21 xii	1530	135 gy. m. st.	W	6–7	W	5	o. c.	991·9	2·22	
WS 34	55° 06′ 00″ S, 35° 11′ 00″ W	21 xii	1915	121 r. st.	WSW	7	WSW	7	c.	990·7	1·11	
WS 35	55° 13′ 15″ S, 34° 59′ 00″ W	21–22 xii	2305	161 s. g	WSW	6–7	WSW	7	o. s.	990·0	1·11	
WS 36	55° 20′ 15″ S, 34° 46′ 30″ W	22 xii	0430	1242	W	5	W	5–6	o. p. s.	989·9	1·11	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 30		400	2·05	34·58	27·66	—	152	3·99	**N 70 H**	100	**0012**	**0019**	¼	KT
tt.		500	2·04	34·60	27·67	—	125	3·97						
		750	1·90	34·69	27·75	—	136	3·79						
		1000	1·86	34·72	27·78	—	129	3·88						
		1500	2·00	34·74	27·79	—	126	4·05						
WS 31	16	0	2·30	33·73	26·95	—	75	—	**N 50 V**	70–0	1600			
		10	1·30	33·78	27·07	—	80	—	**N 70 V**	50–0				
		20	1·20	33·75	27·05	—	83	—	,,	70–50	—	1630		
		30	1·13	33·75	27·05	—	89	—	**N 100 H**	0–5	1653	1723	1	
		40	1·05	33·75	27·06	—	94	—	,,	53	,,	,,	1	KT
		50	0·90	33·82	27·13	—	106	—	**N 70 H**	0–5	1734	1742	¼	
		60	0·65	33·87	27·18	—	106	—	,,	57	,,	,,	¼	KT
WS 32	17	210	0·80	34·13	27·37	—	—	—	**BTS**	225	1220	1300		
WS 33	17	0	1·40	33·78	27·06	—	74	7·46	**N 50 V**	100–0	1530			
		10	1·45	33·78	27·06	—	83	7·60	**N 70 V**	50–0				
		20	1·40	33·78	27·06	—	81	7·48	,,	100–50				
		30	1·30	34·04	27·27	—	75	7·48	,,	130–100	—	1615		
		40	1·23	33·79	27·08	—	81	7·37	**N 100 H**	0–5	1702	1732	1	
		50	1·30	33·79	27·08	—	79	7·46	,,	65	,,	,,	1	
		60	1·00	33·86	27·14	—	80	7·52	,,	130	,,	,,	1	KT. Net touched
		80	0·45	33·88	27·20	—	89	7·65?	**N 70 H**	0–5	1752	1800	¼	bottom
		100	0·40	33·89	27·21	—	99	7·17	,,	97	,,	,,	¼	KT
		125	0·40	33·90	27·22	—	120	7·27						
WS 34	17	0	1·05	33·86	27·14	—	86	—	**N 50 V**	100–0	1915			
		10	1·00	33·84	27·13	—	86	—	**N 70 V**	50–0				
		20	1·00	33·84	27·13	—	88	—	,,	100–50	—	1945		
		30	0·95	33·84	27·13	—	89	—	**N 100 H**	0–5	2010	**2040**	1	
		40	0·95	33·84	27·13	—	91	—	,,	100	,,	,,	1	KT
		50	0·95	33·84	27·13	—	94	—	**N 70 H**	0–5	**2057**	**2105**	¼	
		60	0·95	33·84	27·13	—	99	—	,,	80	,,	,,	¼	KT
		80	0·75	33·87	27·18	—	100							
		100	0·25	33·89	27·22	—	110							
WS 35	17	0	0·60	33·84	27·15	—	93	7·30	**N 50 V**	100–0	**2305**			
		10	0·60	33·83	27·15	—	96	7·46	**N 70 V**	50–0				
		20	0·55	33·83	27·15	—	99	7·25	,,	100–50				
		30	0·60	33·83	27·15	—	101	7·53	,,	150–100	—	**2350**		
		40	0·60	33·83	27·15	—	100	7·26	**N 100 H**	0–5	**0155**	**0225**	1	
		50	0·60	33·83	27·15	—	101	7·34	,,	51	,,	,,	1	
		60	0·60	33·83	27·15	—	94	7·19	,,	102(–51)	,,	,,	1	KT
		80	0·50	33·86	27·17	—	93	7·43	**N 70 H**	0–5	**0255**	**0303**	¼	
		100	0·15	33·91	27·24	—	108	7·07	,,	66	,,	,,	¼	
		105	0·15	34·03	27·34	—	116	6·50	,,	132(–66)	,,	,,	¼	KT
WS 36	18	0	0·63	33·80	27·12	—	91	—	**N 50 V**	100–0	0430			
		10	0·63	33·80	27·12	—	91	—	**N 70 V**	50–0				
		20	0·60	33·78	27·11	—	94	—	,,	100–50				
		30	0·63	33·78	27·11	—	94	—	,,	250–100				
		40	0·63	33·75	27·08	—	95	—	,,	500–250				
		50	0·60	33·80	27·12	—	93	—	,,	750–500				
		60	0·50	33·79	27·13	—	98	—	,,	1000–750	—	0645		
		80	– 0·25	33·81	27·18	—	113	—	**N 100 H**	5–0	0732	0802	1	
		100	– 0·08	33·89	27·23	—	120	—	,,	77	,,	,,	1	
		150	0·90	34·09	27·34	—	125	—	,,	155	,,	,,	1	KT
		200	1·55	34·27	27·44	—	128	—	**N 70 H**	5–0	0832	0840	¼	
		300	2·00	34·43	27·54	—	129	—	,,	67	,,	,,	¼	
		400	2·03	34·51	27·58	—	134	—	,,	135	,,	,,	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 36 *cont.*	55° 20′ 15″ S, 34° 46′ 30″ W	1926 22 xii										
WS 37	54° 45′ 00″ S, 35° 11′ 00″ W	22 xii	1450	318 gy. m.	WSW	1–2	—	0	c.	991·2	2·78	
WS 38	54° 01′ 00″ S, 35° 14′ 00″ W	22–23 xii	2150	2103	N	1	N	1	b.	991·1	2·22	
WS 39	54° 08′ 00″ S, 35° 43′ 00″ W	23 xii	0600	237 gy. m.	NE×N	4	NE × N	3	c.	993·1	2·22	
WS 40	55° 09′ 00″ S, 35° 58′ 00″ W	1927 7 i	0630	183 gy. m.	SW	0–1	—	0	o. s.	999·7	−2·22	
WS 41	54° 32′ 45″ S, 36° 43′ 45″ W	7 i	1400	140 gy. m.	S	3	S	1	o.	998·3	1·11	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 36		500	2·15	34·54	27·62	—	136							
nt.		750	1·99	34·63	27·70	—	132							
		1000	1·81	34·70	27·77	—	126							
WS 37	18	0	1·33	33·84	27·11	—	100	7·30	**N 50 V**	100–0	1450			
		10	0·95	33·84	27·13	—	101	7·27	**N 70 V**	50–0				
		20	0·85	33·84	27·14	—	104	7·31	,,	100–50				
		30	0·83	33·85	27·15	—	100	7·06	,,	250–100				
		40	0·80	33·86	27·15	—	98	7·31	,,	300–250	—	1530		
		50	0·75	33·86	27·16	—	99	7·08	**N 100 H**	0–5	1622	1652	1	
		60	0·70	33·84	27·15	—	100	7·27	,,	80	,,	,,	1	
		80	0·53	33·84	27·16	—	104	7·14	,,	159	,,	,,	1	KT
		100	0·45	33·87	27·19	—	105	7·31	**N 70 H**	0–5	1725	1733	¼	
		150	− 0·03	34·00	27·32	—	114	6·61	,,	64	,,	,,	¼	
		200	0·43	34·13	27·39	—	133	6·09	,,	128(–0)	,,	,,	¼	KT
		300	1·43	34·35	27·52	—	139	4·75						
WS 38	18	0	0·98	33·82	27·12	—	93	7·43	**N 50 V**	100–0	**2150**			
		10	0·95	33·82	27·12	—	94	7·56	**N 70 V**	50–0				
		20	0·90	33·82	27·13	—	95	7·41	,,	100–50				
		30	0·80	33·82	27·13	—	93	7·37	,,	250–100				
		40	0·70	33·82	27·14	—	93	7·48	,,	500–250				
		50	0·30	33·84	27·17	—	100	7·50	,,	750–500				
		60	0·23	33·82	27·17	—	101	7·50	,,	1000–750	—	**0010**		
		80	0·13	33·83	27·18	—	103	7·28	**N 100 H**	0–5	**0247**	**0317**	1	
		100	− 0·20	33·95	27·29	—	114	6·88	,,	53	,,	,,	1	
		150	1·05	34·25	27·46	—	130	5·15	,,	106(–53)	,,	,,	1	KT
		200	1·50	34·36	27·52	—	130	4·62	**N 70 H**	0–5	0405	0413	¼	
		300	1·95	34·43	27·54	—	128	3·93	,,	59	0348	0356	¼	
		400	2·00	34·53	27·62	—	129	3·86	,,	118	,,	,,	¼	KT
		500	2·00	34·58	27·66	—	126	3·66						
		750	1·90	34·69	27·75	—	120	3·77						
		1000	1·73	34·70	27·78	—	125							
		1500	1·47	34·70	27·80	—	125	4·08						
WS 39	19	0	1·80	33·85	27·08	—	94	7·28	**N 50 V**	100–0	0600			
		10	1·75	33·87	27·11	—	100	7·37	**N 70 V**	50–0				
		20	1·70	33·87	27·11	—	103	7·38	,,	100–50				
		30	1·00	33·87	27·16	—	105	7·55	,,	230–100	—	0630		
		40	0·70	33·87	27·18	—	105	7·51	**N 100 H**	0–5	0723	0753	1	
		50	0·70	33·87	27·18	—	98	7·40	,,	87 ?	,,	,,	1	
		60	0·63	33·87	27·18	—	98	7·41	,,	173 ?	,,	,,	1	KT reading doubtful
		80	0·38	33·89	27·21	—	99	7·41	**N 70 H**	0–5	0821	0829	¼	
		100	0·08	33·89	27·23	—	106	7·30	,,	59	,,	,,	¼	
		150	− 0·28	33·96	27·30	—	118	6·85	,,	117	,,	,,	¼	KT
		200	0·43	34·18	27·44	—	130	5·68						
WS 40	5	0	1·19	33·75	27·05	—	100	7·54	**N 50 V**	100–0	0630			
		10	1·24	33·77	27·05		91	7·59	**N 70 V**	50–0				
		20	1·24	33·75	27·04	—	91	7·19	,,	100–50				
		30	1·24	33·77	27·05	—	91	7·49	,,	175–100	—	0730		
		40	1·21	33·77	27·06	—	96	7·45	**N 100 H**	0–5	0812	0842	1	
		50	1·19	33·78	27·08	—	95	7·41	,,	72	,,	,,	1	
		60	1·09	33·78	27·08	—	103	7·35	,,	144	,,	,,	1	KT
		80	0·22	33·87	27·21	—	115	7·26	**N 70 H**	0–5	0908	0916	¼	
		100	− 0·11	33·91	27·25	—	119	7·14	,,	54	,,	,,	¼	
		150	0·49	34·15	27·42	—	134	5·69	,,	108	,,	,,	¼	KT
WS 41	5	0	2·39	33·49	26·76	—	75	—	**N 50 V**	100–0	1400			
		10	2·24	33·55	26·82	—	79	—	**N 70 V**	50–0				
		20	2·19	33·77	26·99	—	78	—	,,	100–50				
		30	2·12	33·80	27·02	—	79	—	,,	140–100	—	1440		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. °Cent.	Remarks
					Direction	Force	Direction	Force				
WS 41 *cont.*	54° 32′ 45″ S, 36° 43′ 45″ W	1927 7 i										
WS 42	54° 41′ 45″ S, 36° 47′ 00″ W	7 i	1800	175 gy. m. st.	S × E	4	S	5	b. c.	999·5	0·55	
WS 43	54° 54′ 00″ S, 36° 50′ 00″ W	7–8 i	2230	200 gy. m. st.	SE	4	S	3	c. p. s.	1002·4	0·0	
WS 44	55° 06′ 00″ S, 36° 57′ 00″ W	8 i	0500	1470	SE × S	3	SE	3	c.	1007·8	0·55	
WS 45	54° 38′ 30″ S, 37° 30′ 55″ W	8 i	1650	180 gy. m. st.	SW	3	SW	3	c.	1014·3	1·11	
WS 46	54° 20′ 15″ S, 37° 32′ 30″ W	8 i	2150	194 gy. m. st.	SW	3	SW	3	o.	1005·8	1·11	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
41		40	1·99	33·81	27·04	—	80	—	**N 100 H**	0–5	1508	1538	1	
t.		50	1·64	33·82	27·08	—	88	—	,,	73	,,	,,	1	
		60	1·04	33·84	27·13	—	104	—	,,	146	,,	,,	1	KT
		80	0·74	33·89	27·19	—	116	—	**N 70 H**	0–5	1604	1612	¼	
		100	0·19	33·93	27·25	—	125	—	,,	55	,,	,,	¼	
		125	0·14	33·96	27·28	—	134	—	,,	109	,,	,,	¼	KT. Water bottle touched bottom at 130 m.
42	5	0	2·39	33·60	26·84	—	75	7·61	**N 50 V**	100–0	1800			
		10	2·24	33·73	26·95	—	73	7·63	**N 70 V**	50–0				
		20	2·12	33·78	27·01	—	78	7·50	,,	100–50				
		30	2·09	33·78	27·01	—	76	7·48	,,	170–100	—	1835		
		40	1·82	33·79	27·04	—	80	7·64	**N 100 H**	0–5	2010	**2040**	1	
		50	1·39	33·81	27·08	—	86	7·73	,,	99	,,	,,	1	
		60	0·89	33·84	27·14	—	105	7·35	,,	198	,,	,,	1	KT
		80	0·32	33·87	27·20	—	115	7·19	**N 70 H**	0–5	**2104**	**2112**	¼	
		100	0·02	33·90	27·24	—	125	7·40	,,	55	,,	,,	¼	
		150	0·19	34·07	27·37	—	135	6·10	,,	110	,,	,,	¼	KT
43	5	0	1·62	33·75	27·02	—	91	—	**N 50 V**	100–0	**2230**			
		10	1·59	33·77	27·03	—	91	—	**N 70 V**	50–0				
		20	1·59	33·75	27·02	—	93	—	,,	100–50				
		30	1·54	33·75	27·02	—	91	—	,,	200–100	—	**2330**		
		40	1·49	33·77	27·04	—	94	—	**N 100 H**	0–5	**2346**	**0016**	1	
		50	1·41	33·81	27·08	—	100	—	,,	70	,,	,,	1	
		60	1·02	33·82	27·12	—	105	—	,,	141	,,	,,	1	KT
		80	0·17	33·87	27·21	—	115	—	**N 70 H**	0–5	**0053**	**0101**	¼	
		100	−0·11	33·89	27·23	—	125	—	,,	62	**0125**	**0133**	¼	
		150	0·12	34·05	27·35	—	139	—	,,	124	**0053**	**0101**	¼	KT
44	6	0	1·49	33·75	27·03	—	98	7·46	**N 50 V**	100–0	0500			
		10	1·49	33·77	27·04	—	101	7·36	**N 70 V**	50–0				
		20	1·49	33·77	27·04	—	110	7·33	,,	100–50				
		30	1·49	33·75	27·03	—	103	7·29	,,	250–100				
		40	1·49	33·75	27·03	—	104	7·28	,,	500–250				
		50	1·49	33·75	27·03	—	105	7·29	,,	750–500				
		60	0·89	33·77	27·08	—	113	7·18	,,	1000–750	—	0740		
		80	0·02	33·77	27·12	—	118	7·20	**N 100 H**	0–5	0839	0909	1	
		100	−0·46	33·85	27·21	—	125	7·05	,,	64	,,	,,	1	
		150	0·59	34·09	27·35	—	129	5·80	,,	128	,,	,,	1	KT
		200	1·72	34·27	27·43	—	136	4·91	**N 70 H**	0–5	0934	0942	¼	
		300	1·69	34·34	27·49	—	137	4·52	,,	79	,,	,,	¼	
		400	2·04	34·45	27·55	—	129	3·97	,,	159	,,	,,	¼	KT
		500	2·04	34·52	27·61	—	126	3·89						
		750	2·08	34·63	27·69	—	125	3·79						
		1000	1·99	34·69	27·74	—	125	3·69						
45	6	0	2·22	33·78	27·00	—	80	7·69	**N 50 V**	100–0	1650			
		10	2·19	33·80	27·01	—	80	7·62	**N 70 V**	50–0				
		20	2·04	33·78	27·02	—	75	7·77	,,	100–50				
		30	1·94	33·79	27·03	—	79	7·76	,,	175–100	—	1735		
		40	1·82	33·79	27·04	—	83	7·68	**N 100 H**	0–5	1801	1831	1	
		50	1·69	33·79	27·05	—	83	7·87	,,	51	,,	,,	1	
		60	1·02	33·80	27·10	—	100	7·54	,,	102	,,	,,	1	KT
		80	0·44	33·84	27·16	—	110	7·61	**N 70 H**	0–5	1856	1904	¼	
		100	−0·44	33·88	27·24	—	120	7·31	,,	53	,,	,,	¼	
		150	0·22	34·06	27·36	—	133	5·93	,,	106	,,	,,	¼	KT
46	6	0	2·19	33·58	26·85	—	85	—	**N 50 V**	100–0	**2150**			
		10	2·19	33·60	26·86	—	85	—	**N 70 V**	50–0				
		20	1·89	33·73	26·98	—	90	—	,,	100–50				
		30	1·69	33·75	27·01	—	91	—	,,	171–50	—	**2240**	—	net touched bottom
		40	1·59	33·75	27·02	—	98	—	**N 100 H**	0–5	**2300**	**2330**	1	at 171 m.

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 46 *cont.*	54° 20′ 15″ S, 37° 32′ 30″ W	1927 8 i										
WS 47	54° 22′ 00″ S, 37° 50′ 00″ W	9 i	0130	160 gy. m. st.	SW	3–4	SW	3	0.	1015·7	1·39	
WS 48	54° 24′ 00″ S, 38° 09′ 00″ W	9 i	0510	224 gy. m. st.	WSW	4	WSW	5	0.	1018·1	2·22	
WS 49	54° 28′ 00″ S, 38° 22′ 15″ W	9 i	0820	223 gy. m. st.	WSW	4	WSW	5	0.	1018·1	2·22	
WS 50	54° 30′ 30″ S, 38° 40′ 30″ W	9 i	1240	230 gy. m.	SW	3	SW	3	0.	1017·5	3·33	
WS 51	54° 34′ 00″ S, 38° 57′ 00″ W	9 i	1535	210 st.	WSW	3	WSW	2	0.	1017·5	3·06	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 46 *lt.*		50	1·22	33·82	27·11	—	101	—	**N 100 H**	73	**2300**	**2330**	1	
		60	0·87	33·82	27·13	—	105	—	,,	143	,,	,,	1	KT
		80	0·19	33·87	27·21	—	119	—	**N 70 H**	0–5	**2356**	**0004**	¼	
		100	0·19	33·90	27·23	—	125	—	,,	87	,,	,,	¼	
		150	0·59	34·09	27·36	—	130	—	,,	174	,,	,,	¼	KT
WS 47	7	0	2·29	33·78	27·00	—	79	7·34	**N 50 V**	100–0	**0130**			
		10	2·29	33·76	26·97	—	84	7·39	**N 70 V**	50–0				
		20	2·24	33·77	26·98	—	84	7·39	,,	100–50				
		30	1·99	33·77	27·00	—	84	7·33	,,	150–100	—	**0205**		
		40	1·87	33·80	27·04	—	89	7·41	**N 100 H**	0–5	**0248**	**0318**	1	
		50	1·59	33·80	27·06	—	94	7·36	,,	63	,,	,,	1	
		60	1·34	33·81	27·09	—	93	7·42	,,	126	,,	,,	1	KT
		80	0·64	33·86	27·16	—	113	7·42	**N 70 H**	0–5	**0338**	0346	¼	
		100	0·29	33·92	27·24	—	116	7·21	,,	39	,,	,,	¼	
		150	0·14	34·02	27·33	—	130	6·17	,,	77	,,	,,	¼	KT
WS 48	7	0	2·09	33·77	26·99	—	88	—	**N 50 V**	100–0	0510			
		10	2·09	33·77	26·99	—	88	—	**N 70 V**	50–0				
		20	2·09	33·77	26·99	—	83	—	,,	100–50				
		30	1·99	33·78	27·02	—	84	—	,,	224–100	—	0545		
		40	1·32	33·85	27·11	—	90	—	**N 100 H**	0–5	0612	0642	1	
		50	0·79	33·89	27·18	—	96	—	,,	96	,,	,,	1	
		60	0·49	33·90	27·21	—	103	—	,,	192	,,	,,	1	KT
		80	0·34	33·91	27·23	—	104	—	**N 70 V**	0–5	0707	0715	¼	
		100	0·02	33·93	27·26	—	123	—	,,	100	,,	,,	¼	
		150	−0·06	34·00	27·32	—	125	—	,,	200	,,	,,	¼	KT
		200	0·64	34·18	27·43	—	139							
WS 49	7	0	2·19	33·78	27·00	—	71	7·88	**N 50 V**	100–0	0820			
		10	2·17	33·80	27·02	—	71	7·87	**N 70 V**	50–0				
		20	2·19	33·80	27·01	—	73	7·77	,,	100–50				
		30	2·19	33·80	27·01	—	71	7·73	,,	225–100	—	0900		
		40	2·14	33·82	27·04	—	73	7·79	**N 100 H**	0–5	0931	1001	1	
		50	1·82	33·82	27·06	—	85	7·36	,,	69	,,	,,	1	
		60	1·34	33·84	27·11	—	108	7·34	,,	137	,,	,,	1	KT
		80	0·62	33·87	27·18	—	115	7·25	**N 70 H**	0–5	1023	1031	¼	
		100	0·34	33·91	27·23	—	125	7·09	,,	80	,,	,,	¼	
		150	0·19	34·02	27·33	—	132	6·20	,,	161	,,	,,	¼	KT
		200	0·99	34·22	27·43	—	139	4·96						
WS 50	7	0	2·22	33·80	27·01	—	88	—	**N 50 V**	100–0	1240			
		10	2·19	33·82	27·03	—	80	—	**N 70 V**	50–0				
		20	2·12	33·84	27·05	—	81	—	,,	100–50				
		30	1·99	33·84	27·06	—	85	—	,,	225–100	—	1315		
		40	1·94	33·84	27·06	—	91	—	**N 100 H**	0–5	1334	1404	1	
		50	1·79	33·85	27·08	—	91	—	,,	71	,,	,,	1	
		60	1·49	33·89	27·14	—	100	—	,,	142	,,	,,	1	KT
		80	0·39	33·90	27·22	—	116	—	**N 70 H**	0–5	1427	1435	¼	
		100	0·09	33·94	27·26	—	124	—	,,	82	,,	,,	¼	
		150	−0·06	34·00	27·32	—	130	—	,,	164	,,	,,	¼	KT
		200	0·89	34·23	27·46	—	139							
WS 51	7	0	2·09	33·82	27·04	—	88	7·41	**N 50 V**	100–0	1535			
		10	2·04	33·80	27·03	—	88	7·43	**N 70 V**	50–0				
		20	1·97	33·82	27·05	—	90	7·34	,,	100–50				
		30	1·97	33·84	27·06	—	89	7·43	,,	210–100	—	1640		
		40	1·89	33·86	27·08	—	93	7·36	**N 100 H**	0–5	1654	1724	1	
		50	1·54	33·86	27·10	—	95	7·39	,,	64	,,	,,	1	
		60	1·12	33·87	27·15	—	103	7·32	,,	128	,,	,,	1	KT
		80	0·19	33·91	27·24	—	118	7·35	**N 70 H**	0–5	1744	1752	¼	
		100	0·07	33·93	27·26	—	121	6·93	,,	58	,,	,,	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 51 *cont.*	54° 34′ 00″ S, 38° 57′ 00″ W	1927 9 i										
WS 52	54° 03′ 30″ S, 38° 35′ 00″ W	10 i	0630	184 gy. m.	NW	3	NW	3	o. m. e.	1012·4	3·06	
WS 53	From 54° 03′ 30″ S, 38° 35′ 00″ W to 53° 29′ 00″ S, 37° 13′ 45″ W	11–12 i	2130	—	var.	1	—	0	o.	1010·8	5·55	
WS 54	53° 29′ 00″ S, 37° 13′ 45″ W	12 i	0320	2281	NW×W	2–3	NW	1	o. f. e.	1017·4	0·83	
WS 55	53° 15′ 30″ S, 37° 13′ 45″ W	12 i	0935	—	NW×W	2–3	NW	1	o. f. e.	1017·4	0·83	
WS 56	Larsen Harbour, Drygalski Fjord, S Georgia	14 i	1300	—	var.	1–2	—	0	c.	998·8	7·2	
WS 57	53° 37′ 00″ S, 36° 51′ 00″ W	17 i	1150	—	NW	3–4	NW	1–2	o.	1004·8	3·33	
WS 58	53° 06′ 15″ S, 37° 06′ 30″ W	17 i	1702	—	NNE	3–4	NNE	1–2	o. p. r.	1001·2	2·5	
WS 59	52° 57′ 00″ S, 37° 06′ 30″ W	17 i	1858	—	NNE	3–4	NNE	3	o. m. d.	995·1	3·3	
WS 60	52° 47′ 00″ S, 37° 06′ 30″ W	17 i	2118	—	NNW	1–2	NNW	1	o. m. d.	994·9	3·1	
WS 61	53° 37′ 30″ S, 37° 06′ 30″ W	18 i	0054	2201 1892 st.	NW	1–2	—	0	o. f. d.	993·2	3·1	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	*σt*	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
51		150	0·24	34·09	27·38	—	132	6·08	**N 70 H**	119	1744	1752	¼	KT
t.		200	1·34	34·29	27·47	—	145	4·66						
52	8	0	1·24	33·86	27·12	—	103	7·36	**N 50 V**	100–0	0630			
		10	1·29	33·86	27·12	—	106	7·25	**N 70 V**	50–0				
		20	1·17	33·86	27·13	—	106	7·27	,,	100–50				
		30	1·02	33·86	27·14	—	104	7·26	,,	180–100	—	0800		
		40	0·97	33·87	27·16	—	103	7·32	**N 100 H**	0–5	0830	0900	1	
		50	0·84	33·87	27·17	—	110	7·26	,,	100	,,	,,	1	
		60	0·39	33·91	27·23	—	113	7·21	**N 70 H**	0–5	0922	0930	¼	
		80	−0·01	33·93	27·26	—	116	7·09	,,	54	,,	,,	¼	
		100	−0·51	33·99	27·34	—	125	6·89	,,	108	,,	,,	¼	KT
		150	−0·51	34·02	27·36	—	134	6·37						
53	10	—	—	—	—	—	—	—	**N 100 H**	0–5	**2130**	**2145**	½	23 consecutive hauls (A–X) of 15 mins. duration
									,,	0–5	**0300**	**0315**		
54	10	0	1·32	33·86	27·12	—	99	7·16	**N 50 V**	100–0	**0320**			
		10	1·14	33·86	27·13	—	105	7·21	**N 70 V**	50–0				
		20	1·00	33·86	27·14	—	110	7·27	,,	100–50				
		30	0·89	33·86	27·15	—	108	7·22	,,	250–100				
		40	0·87	33·86	27·15	—	108	7·28	,,	500–250	—	0420		
		50	0·84	33·86	27·15	—	106	7·18	**N 100 H**	0–5	0656	0726	1	
		60	0·79	33·87	27·17	—	111	7·26	,,	70	,,	,,	1	
		80	0·39	33·87	27·20	—	115	7·24	,,	140	,,	,,	1	KT
		100	−0·21	33·99	27·32	—	128	6·70	**N 70 H**	0–5	0751	0759	¼	
		150	0·84	34·20	27·43	—	140	5·30	,,	70	,,	,,	¼	
		200	1·79	34·38	27·51	—	144	4·11	,,	140	,,	,,	¼	KT
		300	1·99	34·49	27·58	—	158	4·00						
		400	2·02	34·58	27·66	—	156	3·82						
		600	2·00	34·66	27·72	—	150	3·77						
55	10	—	—	—	—	—	—	—	**N 100 H**	0–5	0942	1012	1	
									,,	82	,,	,,	1	
									,,	164	,,	,,	1	KT
56	12	—	—	—	—	—	—	—	**NH**	2	—	—	—	collection of kelp root fauna
57	15	—	—	—	—	—	—	—	**N 100 H**	0–5	1156	1226	1	
									,,	66	,,	,,	1	
									,,	132	,,	,,	1	KT
58	15	—	—	—	—	—	—	—	**N 100 H**	0–5	1708	1738	1	
									,,	100	,,	,,	1	
									,,	200	,,	,,	1	KT
59	15	—	—	—	—	—	—	—	**N 100 H**	0–5	1905	1935	1	
									,,	56	,,	,,	1	
									,,	113	,,	,,	1	KT
60	15	—	—	—	—	—	—	—	**N 100 H**	0–5	**2125**	**2155**	1	
									,,	73	,,	,,	1	
									,,	146	,,	,,	1	KT
									N 70 H	50(–0)	**2220**	**2345**	3	
61	16	0	1·57	33·87	27·12	—	101	7·31	**N 100 H**	0–5	**0100**	**0130**	1	
		10	1·56	33·86	27·10	—	106	7·25	,,	61	,,	,,	1	
		20	1·54	33·86	27·10	—	106	7·24	,,	132	,,	,,	1	KT
		30	1·50	33·86	27·11	—	108	7·19	**N 70 H**	0–5	**0157**	**0205**	¼	
		40	1·48	33·86	27·11	—	109	7·23	,,	80	,,	,,	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 61 *cont.*	53° 37′ 30″ S, 37° 06′ 30″ W	1927 18 i										
WS 62	Wilson Harbour, S Georgia	19 i	1402	15–90	var.	1	—	0	o. f. r.	980·8	4·7	
WS 63	54° 36′ 00″ S, 39° 14′ 00″ W	20–21 i	1830	1752 gy. m. st.	SE	2–3	SE	1	o. c.	996·6	1·4	
WS 64	53° 48′ 45″ S, 38° 34′ 00″ W	21 i	0930 1200	137 gy. m.	ESE	3	ESE	1	o. g.	994·4	2·5	
WS 65	Undine Harbour (North), S Georgia	22 i	1200	—	var.	1	—	0	o.	1001·1	3·6	
WS 66	53° 31′ 15″ S, 42° 03′ 30″ W	18 ii	1005	150 s. st. sh.	W × N	5–6	conf.	6–7	b. q.	979·9	2·8	
WS 67	53° 19′ 00″ S, 45° 16′ 00″ W	20 ii	0615	1839	NNW	2–3	W	3	o. d.	999·8	5·0	mod. W sw

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	*σt*	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
61		50	1·29	33·87	27·14	—	106	7·25	**N 70 H**	159	**0157**	**0205**	¼	KT
t.		60	0·98	33·87	27·16	—	111	7·27	**N 50 V**	100–0	**0230**			
		80	0·30	33·89	27·21	—	114	7·13	**N 70 V**	50–0				
		100	− 0·06	34·05	27·36	—	125	6·41	,,	100–50				
		150	0·69	34·41	27·60	—	139	5·45	,,	250–100				
		200	1·47	34·43	27·58	—	140	4·52	,,	500–250				
		300	1·92	34·54	27·64	—	137	4·01	,,	750–500				
		400	1·92	34·63	27·71	—	142	3·92	,,	1000–750	—	0530		
		500	1·95	34·67	27·73	—	137	3·96						
		750	1·75	34·72	27·79	—	139	3·87						
		1000	1·48	34·72	27·81	—	137	4·08						
		1500	1·04	34·72	27·84	—	133	4·28						
		2000	0·73	34·47	27·66	—	145	3·96						
62	17	—	—	—	—	—	—	—	**BTS**	15–45	1402	1422		
									,,	26–83	1440	1504		
63	18	0	2·58	33·71	26·91	—	95	7·24	**N 50 V**	100–0	1830			
		10	2·58	33·71	26·91	—	100	7·16	**N 70 V**	50–0				
		20	2·54	33·71	26·92	—	96	7·23	,,	100–50				
		30	2·52	33·71	26·92	—	100	7·25	,,	250–100				
		40	2·41	33·71	26·93	—	100	7·26	,,	500–250				
		50	1·22	33·77	27·05	—	106	7·36	,,	750–500				
		60	0·77	33·78	27·10	—	108	7·31	,,	1000–750	—	**2030**		
		80	− 0·26	33·82	27·19	—	119	7·15	**N 100 H**	0–5	**2301**	**2331**	1	
		100	− 0·61	33·89	27·25	—	123	7·06	,,	79	,,	,,	1	
		150	0·65	34·13	27·38	—	130	5·87	,,	157	,,	,,	1	KT
		200	1·54	34·25	27·42	—	133	4·95	**N 70 H**	0–5	**0006**	**0014**	¼	
		300	2·17	34·41	27·50	—	140	4·47	,,	80	,,	,,	¼	
		400	2·21	34·52	27·59	—	144	3·85	,,	161	,,	,,	¼	KT
		500	2·09	34·54	27·62	—	137	3·77						
		750	2·09	34·66	27·71	—	130	3·92						
		1000	1·82	34·71	27·78	—	130	4·00						
64	19	—	—	—	—	—	—	—	—	—	—	—	—	current measurements by Ekman meter
65	20	—	—	—	—	—	—	—	**Sh. coll.**	—	1200			
66	17	—	—	—	—	—	—	—	**N 100 H**	0–5	1005	1035	1	
									,,	88	,,	,,	1	KT
									N 70 H	0–5	1054	1101	¼	
									,,	63	1058	1106	¼	
									,,	125	,,	,,	¼	KT
67	19	0	3·69	33·80	26·88	—	—	—	**N 50 V**	100–0	0615			
		10	3·72	33·80	26·88	—	—	—	**N 70 V**	50–0				
		20	3·64	33·80	26·89	—	—	—	,,	100–50				
		30	3·56	33·80	26·89	—	—	—	,,	250–100				
		40	3·44	33·80	26·91	—	—	—	,,	500–250				
		50	3·39	33·78	26·90	—	—	—	,,	750–500				
		60	3·36	33·77	26·89	—	—	—	,,	1000–300				
		80	1·26	33·89	27·15	—	—	—	,,	1000–750	—	1030		
		100	1·16	33·95	27·21	—	—	—	**N 100 H**	0–5	1107	1137	1	
		150	1·53	34·04	27·25	—	—	—	,,	66	1200	1230	1	
		200	1·48	34·11	27·32	—	—	—	,,	133	1107	1137	1	KT
		300	2·09	34·23	27·37	—	—	—	**N 70 H**	0–5	1240	1248	¼	
		400	2·33	34·36	27·45	—	—	—	,,	66	,,	,,	¼	
		500	2·21	34·40	27·49	—	—	—	,,	133	,,	,,	¼	KT
		750	2·18	34·56	27·62									
		1000	2·13	34·63	27·69									
		1500	1·80	34·72	27·78									

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 68	52° 53′ 00″ S, 48° 48′ 00″ W	1927 21 ii	0215	3197	SW	5–6	SW	6	c.	994·7	6·6	
WS 69	52° 19′ 00″ S, 52° 11′ 00″ W	22 ii	0015	2743	NNW	3	W	3	o. r.	996·5	6·93	W swell
WS 70	51° 58′ 00″ S, 55° 42′ 00″ W	22–23 ii	2145	—	NE	3	conf.	3	o. p.	1000·9	6·93	conf. swell
WS 71	6 miles N 60° E of C Pembroke Lt, E Falkland I	23 ii	1355	82 s. 80 s.	NNW	6	NNW	5	o.	998·0	11·4	slight conf. s
WS 72	51° 38′ 00″ S, 57° 32′ 30″ W 51° 07′ 00″ S, 57° 34′ 00″ W	5 iii	1340 1620	95 s. sh. 95	NW×W	5	NW×W	5	c.	1009·3	7·8	
WS 73	51° 01′ 00″ S, 58° 54′ 00″ W. From 51° 02′ 00″ S, 58° 55′ 00″ W to 51° 00′ 00″ S, 58° 53′ 00″ W	6 iii	0700 0840	121 f. d. s. 130	WNW	5	WNW	4	b. c.	1007·8	10·0	NW swell

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
68	20	0	5·29	33·96	26·84	—	—	—	**N 50 V**	100–0	**0215**			
		10	5·22	33·95	26·83	—	—	—	**N 70 V**	50–0				
		20	5·18	33·95	26·84	—	—	—	,,	100–50				
		30	5·15	33·95	26·84	—	—	—	,,	250–100				
		40	5·18	33·95	26·84	—	—	—	,,	500–250				
		50	5·14	33·96	26·85	—	—	—	,,	750–500				
		60	4·90	34·03	26·94	—	—	—	,,	1000–750	—	**0452**		
		80	4·12	34·16	27·13	—	—	—	**N 100 H**	0–5	0630	0701	1	
		100	3·96	34·16	27·14	—	—	—	,,	80	0631	,,	1	
		150	3·48	34·16	27·19	—	—	—	,,	161	,,	,,	1	KT
		200	3·41	34·16	27·20	—	—	—	**N 70 H**	0–5	0722	0730	¼	
		300	3·00	34·22	27·28	—	—	—	,,	66	0723	0731	¼	
		400	2·82	34·23	27·31	—	—	—	,,	132	,,	,,	¼	KT
		500	2·48	34·26	27·36									
		750	2·54	34·42	27·48									
		1000	2·36	34·56	27·61									
69	21	0	7·01	34·07	26·71	—	—	—	**N 70 V**	50–0	**0015**			
		10	7·00	34·07	26·71	—	—	—	,,	100–50				
		20	6·97	34·07	26·71	—	—	—	,,	250–100	—	**0100**		
		30	6·97	34·07	26·71	—	—	—	**N 100 H**	0–5	**0244**	**0315**	1	
		40	6·88	34·11	26·76	—	—	—	,,	73	,,	**0322**	1	
		50	6·77	34·07	26·74	—	—	—	,,	146	,,	,,	1	KT
		60	6·79	34·07	26·74	—	—	—	**N 70 H**	0–5	**0348**	**0356**	¼	
		80	6·71	34·09	26·76	—	—	—	,,	55	**0344**	**0351**	¼	
		100	4·23	34·09	27·05	—	—	—	,,	110	,,	,,	¼	KT
		150	3·80	34·16	27·16	—	—	—	**N 70 V**	500–250	0630			
		200	3·42	34·13	27·17	—	—	—	,,	750–500				
		300	2·81	34·11	27·22	—	—	—	,,	1000–750				
		400	2·57	34·16	27·27	—	—	—	**N 50 V**	100–0	—	0800		
		500	2·42	34·18	27·31									
		750	2·51	34·31	27·40									
		1000	2·46	34·44	27·50									
70	21	0	7·20	34·04	26·66	—	—	—	**N 50 V**	100–0	**2145**			
		10	7·19	34·07	26·68	—	—	—	**N 70 V**	50–0				
		20	7·14	34·08	26·70	—	—	—	,,	100–50				
		30	7·14	34·07	26·69	—	—	—	,,	250–100				
		40	6·91	34·07	26·72	—	—	—	,,	500–250				
		50	6·85	34·07	26·73	—	—	—	,,	750–500				
		60	6·77	34·07	26·74	—	—	—	,,	1000–750	—	**0026**		
		80	5·80	34·11	26·89	—	—	—	**N 100 H**	0–5	**0049**	**0119**	1	
		100	5·01	34·16	27·03	—	—	—	,,	73	,,	,,	1	
		150	4·35	34·16	27·10	—	—	—	,,	146	,,	,,	1	KT
		200	4·24	34·16	27·11	—	—	—	**N 70 H**	0–5	**0141**	**0149**	¼	
		300	4·07	34·19	27·16	—	—	—	,,	86	,,	,,	¼	
		400	3·89	34·19	27·18	—	—	—	,,	172	,,	,,	¼	KT
		500	3·76	34·19	27·19									
		750	3·25	34·20	27·25									
		1000	2·94	34·28	27·34									
71	21	0	9·24	33·78	26·15	—	—	—	**OTC**	82–80	1410	1514	2	
		90	7·76	33·91	26·48									
72	3	0	8·51	33·82	26·43	—	—	—	**OTC**					
		95	7·38	33·91	26·72	—	—	—	**N 7–T**	95	1520	1550	2	
									N 4–T					
									NCS–T					
73	4	0	9·38	33·80	26·14	—	—	—	**OTC**					
		130	6·71	33·87	26·60	—	—	—	**N 7–T**	121–130	0715	0810	3	
									N 4–T					
									NCS–T					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
		1927										
WS 74	Anchorage, Elephant Jason I, W Falkland	10 iii	1400	7	—	0	—	0	b.	1014·4	11·0	W swell
WS 75	51° 01′ 30″ S, 60° 31′ 00″ W. From 51° 00′ 00″ S, 60° 30′ 00″ W to 51° 02′ 42″ S, 60° 31′ 42″ W	10 iii	1730 1850	64 104	—	0	—	0	b. c.	1012·5	10·0	W swell
WS 76	51° 00′ 00″ S, 62° 02′ 30″ W. From 51° 00′ 00″ S, 62° 00′ 00″ W to 51° 00′ 00″ S, 62° 04′ 36″ W	11 iii	1325 1518	207 f. d. s. 205	NNW	4	NNW	3	b. c.	1000·6	11·10	
WS 77	51° 01′ 00″ S, 66° 31′ 30″ W. From 51° 00′ 00″ S, 66° 30′ 00″ W to 51° 02′ 00″ S, 66° 33′ 00″ W	12 iii	0935 1145	110 c. d. s. 113	W × S	6	W	6	b.	1002·8	11·4	
WS 78	51° 01′ 00″ S, 68° 04′ 30″ W. From 51° 01′ 00″ S, 68° 02′ 00″ W to 51° 01′ 00″ S, 68° 07′ 00″ W	13 iii	0550 0805	95 f. d. s. 71	NW	4	NW	4	b. c.	997·4	13·0	
WS 79	51° 01′ 30″ S, 64° 59′ 30″ W. From 51° 00′ 00″ S, 65° 00′ 00″ W to 51° 03′ 00″ S, 64° 59′ 00″ W	13 iii	1932 2225	132 f. d. s. 131	SSW	2	—	0	b. c.	1003·5	11·4	slight NW s
WS 80	50° 57′ 00″ S, 63° 37′ 30″ W. From 50° 58′ 00″ S, 63° 39′ 00″ W to 50° 55′ 30″ S, 63° 36′ 00″ W	14 iii	0602 0822	152 f. d. s. 156	SW	3–4	SW	3	b. c.	1010·8	9·6	
WS 81	8 miles N 11° W of North I, W Falkland I. From 51° 30′ 00″ S, 61° 15′ 00″ W to 51° 30′ 30″ S, 61° 10′ 00″ W	19 iii	0653 0820	81 s. 82	S	2	S	1	b. c.	1016·3	10·0	
WS 82	54° 06′ 00″ S, 57° 46′ 00″ W. From 54° 05′ 00″ S, 57° 45′ 00″ W to 54° 07′ 00″ S, 57° 47′ 30″ W	21 iii	0453 0630	140 144	N × E	2–5	N × E	4	o. w.	982·6	7·5	wind and rising du trawling
WS 83	14 miles S 64° W of George I, E Falkland I. From 52° 28′ 00″ S, 60° 06′ 00″ W to 52° 30′ 00″ S, 60° 09′ 30″ W	24 iii	1032 1255	137 f. gn. s. sh. 129	SW	6	SW	6	b. c.	997·4	8·0	
WS 84	7½ miles S 9° W of Sea Lion I, E Falkland I. From 52° 33′ 00″ S, 59° 08′ 00″ W to 52° 34′ 30″ S, 59° 11′ 00″ W	24 iii	1640 1835	75 c. s. sh. st. 74	SSW	6	SSW	6	b. c.	1000·3	6·95	
WS 85	8 miles S 66° E of Lively I, E Falkland I. From 52° 09′ 00″ S, 58° 14′ 00″ W to 52° 08′ 00″ S, 58° 09′ 00″ W	25 iii	1645 1830	79 s. sh. 79	SE	2	SE	1	o.	1005·6	9·5	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
74	8	—	—	—	—	—	—	—	**LH**	7	1400	1500		
75	8	0	9·61	33·83	26·13	—	—	—	**OTC**					
		65	8·14	33·85	26·36	—	—	—	**N 7–T**	64–104	1742	1834	3	
									N 4–T					
									NCS–T					
76	9	0	9·42	33·72	26·07	—	—	—	**DC**	207	1325	1340		
		200	5·90	34·04	26·82	—	—	—	**OTC**					
									N 7–T	207–205	1404	1453	3	
									N 4–T					
									NCS–T					
77	10	0	9·77	33·40	25·77	—	—	—	**DC**	110	0935	1000		
		115	8·30	33·43	26·02	—	—	—	**OTC**					
									N 7–T	110–113	1035	1132	3	
									N 4–T					
									NCS–T					
78	11	0	10·32	33·01	25·37	—	—	—	**DC**	95	0550	0601		
		85	7·86	33·06	25·79	—	—	—	**OTC**					
									N 7–T	95–71	0645	0745	3	
									N 4–T					
									NCS–T					
79	11	0	9·26	33·62	26·03	—	—	—	**DC**	132	**1932**	**1945**		
		125	7·83	33·64	26·25	—	—	—	**OTC**					
									N 7–T	132–131	**2015**	**2115**	3	
									N 4–T					
									NCS–T					
80	12	0	9·21	33·69	26·08	—	—	—	**DC**	152	0602	0617		
		150	6·77	33·72	26·47	—	—	—	**OTC**					
									N 7–T	152–156	0701	0805	3	
									N 4–T					
									NCS–T					
81	16	0	8·90	33·86	26·26	—	—	—	**OTC**					
		75	8·22	33·89	26·39	—	—	—	**N 7–T**	81–82	0705	0802	3	
									N 4–T					
									NCS–T					
82	18	0	6·64	34·05	26·74	—	—	—	**OTC**					
		130	6·62	34·08	26·76	—	—	—	**N 7–T**	140–144	**0518**	**0550**	2·5	
									N 4–T					
									NCS–T					
83	20	0	8·43	33·73	26·23	—	—	—	**DC**	137	1040	1055		
		120	7·60	33·83	26·44	—	—	—	**OTC**					
									N 7–T	137–129	1125	1225	3	
									N 4–T					
									NCS–T					
84	20	0	8·23	33·75	26·28	—	—	—	**DC**	75	1640	1650		
		70	8·20	33·76	26·29	—	—	—	**OTC**					
									N 7–T	75–74	1710	1815	3	
									N 4–T					
									NCS–T					
85	21	0	8·38	33·78	26·29	—	—	—	**DC**	79	1645	1650		
		75	8·30	33·79	26·30	—	—	—	**OTC**					
									N 7–T	79	1715	**1815**	3	
									N 4–T					
									NCS–T					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 86	53° 53′ 30″ S, 60° 34′ 30″ W.	1927 3 iv	0556	151 s. sh. st.	NW	3–4	—	0	o. g.	986·7	8·5	NW swell
	From 53° 53′ 00″ S, 60° 37′ 00″ W		0925	147								
	to 53° 54′ 00″ S, 60° 32′ 00″ W											
WS 87	54° 07′ 30″ S, 58° 16′ 00″ W.	3 iv	1745	96 s. st. sh.	var.	1–2	—	0	o.	983·6	7·78	conf. swell
	From 54° 09′ 00″ S, 58° 16′ 00″ W		2000	127								
	to 54° 06′ 00″ S, 58° 16′ 00″ W											
WS 88	54° 00′ 00″ S, 64° 57′ 30″ W.	6 iv	1540	118 s. sh. st.	NE	4–5	NE	5	b. c.	993·0	7·22	
	From 54° 00′ 00″ S, 65° 00′ 00″ W		1730	118								
	to 54° 00′ 00″ S, 64° 55′ 00″ W											
WS 89	9 miles N 21° E of Arenas Pt Lt, Tierra del Fuego.	7 iv	1037	23 m. g. st.	SW	1	—	0	o. c.	993·0	8·89	ENE swell
	From 53° 01′ 00″ S, 68° 07′ 00″ W		1220	21								
	to 52° 59′ 30″ S, 68° 06′ 00″ W											
WS 90	13 miles N 83° E of C Virgins Lt, Argentine Republic.	7 iv	1727	82 f. d. s.	NE	0–1	—	0	b. w. c.	996·4	9·44	NNE swell
	From 52° 18′ 00″ S, 68° 00′ 00″ W		1912	81								
	to 52° 19′ 30″ S, 67° 57′ 00″ W											
WS 91	52° 53′ 45″ S, 64° 37′ 30″ W.	8 iv	0654	191 f. d. s. sh.	—	0	—	0	o. g. p.	997·8	9·16	N swell
	From 52° 54′ 30″ S, 64° 39′ 00″ W		0920	205								
	to 52° 53′ 00″ S, 64° 36′ 00″ W											
WS 92	51° 58′ 30″ S, 65° 01′ 00″ W.	8 iv	1442	145 f. d. s. st.	—	0	—	0	s. p. r.	999·3	8·89	N × E swell
	From 52° 00′ 00″ S, 65° 00′ 00″ W		1635	143								
	to 51° 57′ 00″ S, 65° 02′ 00″ W											
WS 93	7 miles S 80° W of Beaver I, W Falkland I	9 iv	0511	133 gy. s.	—	0	—	0	b. c.	1006·0	7·5	SE swell
	From 51° 51′ 00″ S, 61° 30′ 00″ W		0710	130								
	to 51° 54′ 00″ S, 61° 30′ 00″ W											
WS 94	50° 00′ 15″ S, 64° 57′ 45″ W.	16 iv	0705	110 f. d. s.	NW	2	NE × N	4	o.	1009·4	8·89	
	From 50° 00′ 00″ S, 65° 00′ 00″ W		0908	126	NE × N	5	NE × N	4	o.	1009·4	8·89	
	to 50° 00′ 30″ S, 64° 55′ 30″ W											
WS 95	48° 58′ 15″ S, 64° 45′ 00″ W.	17 iv	0521	109 f. d. s. st. sh.	NW	2–3	—	0	c.	999·1	11·9	NW swell
	From 48° 57′ 00″ S, 64° 45′ 00″ W											
	to 48° 59′ 30″ S, 64° 45′ 00″ W		0850	108								
WS 96	48° 00′ 45″ S, 64° 58′ 00″ W.	17 iv	1422	96 f. d. s.	var.	1	—	0	b. c.	1001·8	12·2	N × E swell
	From 48° 00′ 00″ S, 65° 00′ 00″ W		1719	96								
	to 48° 01′ 30″ S, 64° 56′ 00″ W											

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
86	2	0	7·09	33·96	26·61	—	—	—	**DC**	151	**0556**	**0612**		
		140	6·82	34·00	26·67	—	—	—	**OTC**					
									N 7–T					
									N 4–T	151–147	0755	0855	3	
									NCS–T					
87	2	0	6·67	34·09	26·76	—	—	—	**DC**	96	**1745**	**1800**		
		120	6·77	34·00	26·68	—	—	—	**OTC**					
									N 7–T					
									N 4–T	96–127	**1815**	**1910**	3	
									NCS–T					
88	5	0	8·805	33·35	25·88	—	—	—	**DC**	118	1540	1550		
		110	8·18	33·46	26·05	—	—	—	**OTC**					
									N 7–T					
									N 4–T	118	1608	1713	3	trawl torn in two places
									NCS–T					
89	6	0	9·29	32·88	25·43	—	—	—	**DC**	23	1037	1043		
		18	9·27	32·88	25·44	—	—	—	**OTC**					
									N 7–T					
									N 4–T	23–21	1130	1205	1·6	
									NCS–T					
90	6	0	9·07	32·90	25·48	—	—	—	**DC**	82	1727	**1735**		
		75	8·86	32·95	25·56	—	—	—	**OTC**					
									N 7–T					
									N 4–T	82–81	**1752**	**1852**	2·4	
									NCS–T					
91	7	0	8·32	33·33	25·93	—	—	—	**DC**	191	0654	0705		
		200	7·34	33·83	26·47	—	—	—	**OTC**					
									N 7–T					
									N 4–T	191–205	0800	0906	2·4	
									NCS–T					
92	7	0	8·80	33·31	25·85	—	—	—	**DC**	145	1442	1450		
		135	8·17	33·48	26·07	—	—	—	**OTC**					
									N 7–T					
									N 4–T	145–143	1515	1617	3	
									NCS–T					
93	8	0	8·16	33·70	26·26	—	—	—	**DC**	133	**0511**	**0520**		
		125	7·30	33·88	26·52		—	—	**OTC**					
									N 7–T					
									N 4–T	133–130	**0550**	0652	3	trawl torn
									NCS–T					
94	14	0	8·48	33·44	26·00	—	—	—	**DC**	110	0705	0715		
		120	7·95	33·34	26·00	—	—	—	**OTC**	110–126	0747	0847	3	
95	15	0	9·70	33·42	25·80	—	—	—	**DC**	109	**0521**	**0522**		
		100	8·33	33·40	25·99	—	—	—	**OTC**	109–108	**0615**	0720	2·6	
									TYF	30(–0)	0810	0841	0·4	
96	15	0	10·41	33·24	25·53	—	—	—	**DC**	96	1422	1432		
		90	10·04	33·30	25·63	—	—	—	**OTC**	96	1553	1653	3	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 97	49° 00′ 30″ S, 61° 58′ 00″ W. From 49° 00′ 00″ S, 62° 00′ 00″ W to 49° 01′ 00″ S, 61° 56′ 00″ W	1927 18 iv	0525 0750	146 s. g. st. 145	ENE	2–3	—	0	g. o. r.	995·1	9·7	conf. swell
WS 98	49° 54′ 15″ S, 60° 35′ 30″ W. From 49° 53′ 00″ S, 60° 37′ 00″ W to 49° 55′ 30″ S, 60° 34′ 00″ W	18 iv	1605 1815	173 f. d. s. 171	SE	6	SE	5	g. o. m.	989·7	7·78	
WS 99	49° 42′ 00″ S, 59° 14′ 30″ W. From 49° 41′ 00″ S, 59° 14′ 00″ W to 49° 43′ 00″ S, 59° 15′ 00″ W	19 iv	0510 0735	251 f. d. s. 225	S × W	5–6	S × W	5	b. c.	995·4	7·22	
WS 100	50° 53′ 00″ S, 61° 26′ 00″ W	23 iv	0410	132	W	4	W × N	4	c.	1008·5	8·3	
WS 101	50° 27′ 00″ S, 62° 06′ 00″ W	23 iv	1105	164	W	3	W	3	o. c.	1008·9	9·1	
WS 102	50° 05′ 00″ S, 62° 37′ 00″ W	23 iv	1630	147	W	2–3	W	3	b.	1009·1	8·8	
WS 103	49° 40′ 00″ S, 63° 13′ 00″ W	23–24 iv	2240	150	NW	2–3	NW	3	b. w.	1005·9	9·7	
WS 104	49° 18′ 00″ S, 63° 40′ 00″ W	24 iv	0505	137	NNW	3	NNW	4	b.	999·9	10·0	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
97	16	0	8·90	33·71	26·16	—	—	—	**DC**	146	**0525**	**0542**		
		140	6·41	33·89	26·65	—	—	—	**OTC**	146–145	**0620**	0730	2·8	
98	16	0	9·07	33·83	26·21	—	—	—	**DC**	173	1605	1612		
		165	5·30	33·98	26·85	—	—	—	**OTC**	173–171	1645	1755	3	
99	17	0	8·25	33·84	26·35	—	—	—	**DC**	251	**0510**	**0527**		
		220	5·94	34·00	26·79	—	—	—	**OTC**	251–225	**0605**	0710	2·3	
00	21	0	7·78	33·79	26·38	—	78	—	**N 50 V**	100–0	**0425**			
		10	7·74	33·78	26·38	—	80	—	**N 70 V**	50–0				
		20	7·73	33·82	26·41	—	80	—	,,	122–50	—	**0515**		
		30	7·70	33·77	26·37	—	80	—	**N 100 H**	0–5	**0546**	**0616**	1	
		40	7·68	33·76	26·37	—	81	—	,,	61	,,	,,	1	
		50	7·68	33·77	26·37	—	84	—	,,	122	,,	,,	1	KT. Net touched bottom
		60	7·66	33·80	26·40	—	88	—	**N 70 H**	0–5	**0646**	0654	¼	
		80	7·58	33·81	26·42	—	90	—	,,	49	,,	,,	¼	
		100	7·50	33·81	26·44	—	96	—	,,	99	,,	,,	¼	KT
		125	7·39	33·84	26·47	—	98							
01	21	0	8·20	33·66	26·21	—	70	—	**N 70 V**	50–0	1105			
		10	8·14	33·66	26·22	—	79	—	,,	100–50				
		20	8·11	33·62	26·20	—	76	—	,,	150–100				
		30	8·23	33·59	26·16	—	76	—	**N 50 V**	100–0	—	1135		
		40	8·11	33·65	26·22	—	76	—	**N 100 H**	0–5	1153	1222	1	
		50	8·10	33·65	26·22	—	76	—	,,	52	,,	1226	1	
		60	8·09	33·66	26·23	—	78	—	,,	104	,,	,,	1	KT
		80	7·71	33·71	26·23	—	89	—	**N 70 H**	0–5	1245	1253	¼	
		100	7·62	33·79	26·40	—	91	—	,,	57	,,	,,	¼	
		155	6·96	33·87	26·57	—	105	—	,,	114	,,	,,	¼	KT
02	21	0	8·97	33·64	26·08	—	70	—	**N 50 V**	100–0	1630			
		10	8·47	33·64	26·16	—	70	—	**N 70 V**	50–0				
		20	8·48	33·65	26·16	—	71	—	,,	100–50	—	1645		
		30	8·41	33·64	26·17	—	71	—	**N 100 H**	0–5	1700	**1730**	1	
		40	8·41	33·64	26·17	—	71	—	,,	44	,,	,,	1	
		50	8·41	33·64	26·17	—	71	—	,,	88	,,	,,	1	KT
		60	8·32	33·64	26·18	—	74	—	**N 70 H**	0–5	**1751**	**1800**	¼	
		80	8·37	33·68	26·20	—	74	—	,,	45	,,	,,	¼	
		100	7·06	33·73	26·43	—	99	—	,,	90	,,	,,	¼	KT
03	21–22	0	8·49	33·67	26·17	—	70	—	**N 50 V**	100–0	**2240**			
		10	8·44	33·67	26·18	—	70	—	**N 70 V**	50–0				
		20	8·44	33·64	26·16	—	73	—	,,	111–50	—	**2315**		
		30	8·44	33·64	26·16	—	73	—	**N 100 H**	0–5	**2319**	**2350**	1	
		40	8·39	33·64	26·17	—	75	—	,,	54	,,	,,	1	
		50	8·34	33·64	26·18	—	75	—	,,	108	,,	,,	1	KT
		60	8·39	33·67	26·19	—	78	—	**N 70 H**	0–5	**0017**	**0028**	¼	
		80	6·70	33·68	26·44	—	103	—	,,	55	,,	,,	¼	
		100	6·64	33·64	26·42	—	106	—	,,	110	,,	,,	¼	KT
04	22	0	8·24	33·57	26·13	—	76	—	**N 50 V**	100–0	**0505**			
		10	8·24	33·52	26·10	—	76	—	**N 70 V**	50–0	—	—	—	no catch: haul repeated at 0900
		20	8·24	33·52	26·10	—	75	—	,,	100–50	—	**0535**		
		30	8·24	33·52	26·10	—	85	—	**N 100 H**	0–5	**0601**	**0631**	1	
		40	8·24	33·57	26·13	—	84	—	,,	59	0657	0727	1	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 104 *cont.*	49° 18′ 00″ S, 63° 40′ 00″ W	1927 24 iv										
WS 105	48° 50′ 00″ S, 64° 24′ 00″ W	24 iv	1515	109	NW	3	NW	4	b.	999·5	11·6	
WS 106	48° 25′ 00″ S, 65° 00′ 00″ W	24 iv	2145	110	NW	1	—	0	b.	1002·4	13·3	
WS 107	48° 00′ 00″ S, 65° 29′ 00″ W	25 iv	0615	60	NW	2–3	NW	3	b.	1002·0	13·0	
WS 108	48° 30′ 45″ S, 63° 33′ 45″ W. From 48° 30′ 00″ S, 63° 36′ 00″ W to 48° 31′ 30″ S, 63° 31′ 30″ W	25 iv	1625 1825	118 f. d. s. 120	NNW	3	NNW	2	b.	1003·0	13·0	
WS 109	50° 18′ 48″ S, 58° 28′ 30″ W. From 50° 19′ 00″ S, 58° 27′ 00″ W to 50° 18′ 36″ S, 58° 30′ 00″ W	26 iv	1630	145 f. d. s.	WSW	6–7	WSW	6	b. c.	1016·4	7·7	
WS 110	53° 46′ 00″ S, 35° 47′ 00″ W	26 v	1100	988	W	6	W	6	b.	994·9	− 1·7	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
04		50	8·24	33·57	26·13	—	84	—	**N 100 H**	119	**0601**	**0631**	1	KT
		60	8·24	33·62	26·18	—	84	—	**N 70 H**	0–5	0744	0752	¼	
		80	8·28	33·63	26·18	—	88	—	,,	55	,,	,,	¼	
		90	7·00	33·57	26·31	—	103	—	,,	110	,,	,,	¼	KT
		100	7·00	33·57	26·31	—	103	—	**N 70 V**	50–0	0900			
		130	6·95	33·56	26·31	—	106							
05	22	0	8·88	33·49	25·98	—	75	—	**N 50 V**	100–0	1515			
		10	8·84	33·55	26·03	—	74	—	**N 70 V**	50–0				
		20	8·80	33·55	26·04	—	78	—	,,	95–50	—	1540		
		30	8·76	33·55	26·05	—	78	—	**N 100 H**	0–5	1615	1645	1	
		40	8·76	33·55	26·05	—	78	—	,,	50	,,	,,	1	
		50	8·50	33·55	26·09	—	84	—	,,	101	,,	,,	1	KT
		60	8·47	33·51	26·06	—	84	—	**N 70 H**	0–5	**1705**	**1713**	¼	
		80	8·44	33·48	26·03	—	88	—	,,	50	,,	,,	¼	
		100	8·45	33·49	26·04	—	99	—	,,	100	,,	,,	¼	KT
06	22	0	9·88	33·22	25·61	—	68	—	**N 50 V**	100–0	**2145**			
		10	9·88	33·28	25·65	—	68	—	**N 70 V**	50–0				
		20	9·83	33·30	25·67	—	73	—	,,	89–50	—	**2215**		
		30	9·82	33·28	25·66	—	73	+	**N 100 H**	0–5	**2232**	**2302**	1	
		40	9·72	33·30	25·68	—	73	+	,,	50	,,	,,	1	
		50	9·61	33·31	25·72	—	73	+	,,	100	,,	,,	1	KT
		60	9·56	33·34	25·75	—	73	+	**N 70 H**	0–5	**2332**	**2342**	¼	
		80	9·44	33·33	25·76	—	73	—	,,	41	,,	,,	¼	
		100	9·43	33·35	25·78	—	80	—	,,	82	,,	,,	¼	KT
07	23	0	10·55	33·06	25·36	—	70	—	**N 50 V**	58–0	**0615**			
		10	10·54	33·06	25·36	—	70	—	**N 70 V**	58–0	—	**0628**		
		20	10·53	33·06	25·36	—	80	—	**N 100 H**	0–5	**0634**	**0705**	1	
		30	10·53	33·08	25·38	—	75	—	,,	60	,,	,,	1	KT
		40	10·51	33·10	25·40	—	73	—	**N 70 H**	0–5	0715	0723	¼	
		50	10·51	33·12	25·42	—	88	—	,,	56	,,	,,	¼	KT
08	23	0	9·29	33·58	25·99	—	—	—	**DC**	118	1625	1635		
		110	6·92	33·58	26·34	—		—	**OTC**	118–120	1658	**1759**	3·3	
09	24	—	—	—	—	—	—	—	**DC**	145	1640	1651		
									OTC	145	**1713**	**1813**	2·0	
10	24	0	0·93	33·77	27·07	—	—	—	**N 50 V**	100–0	1100			
		10	0·94	33·77	27·07	—	—	—	**N 70 V**	50–0				
		20	0·94	33·78	27·09	—			,,	100–50				
		30	0·94	33·78	27·09		—	—	,,	250–100				
		40	0·94	33·78	27·09	—	—		,,	500–300				
		50	0·94	33·77	27·07	—	—	—	,,	750–500				
		60	0·96	33·78	27·09	—	—	—	,,	980–750	—	**1600**		
		80	0·99	33·78	27·09	—	—	—	**N 100 H**	0–5	**1634**	**1704**	1	
		100	1·00	33·80	27·10	—	—	—	,,	51	,,	,,	1	
		150	1·15	34·19	27·40	—	—	—	,,	102(–0)	,,	,,	1	KT
		200	1·48	34·27	27·45	—	—		**N 70 H**	0–5	**1741**	**1749**	¼	
		300	1·88	34·39	27·51	—	—	—	,,	62	,,	,,	¼	
		400	2·03	34·52	27·61	—		—	,,	124	,,	,,	¼	KT
		500	2·07	34·60	27·67									
		750	1·91	34·65	27·72									
		900	1·85	34·70	27·77									

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 111	53° 39′ 00″ S, 35° 34′ 00″ W	1927 26–27 v	1930	1500	SW	2–3	SW	3	b.	990·5	− 1·7	
WS 112	53° 54′ 30″ S, 36° 06′ 00″ W	27 v	1100	155 st.	W × N	5	W × N	3–4	c.	998·6	− 1·1	
WS 113	54° 07′ 00″ S, 36° 24′ 00″ W	28 v	0845	155 gy. m. st.	WNW	6	WNW	6	b. c.	995·4	0·0	
WS 114	54° 00′ 00″ S, 36° 12′ 00″ W	28 v	1215	163	W	6	W	4	c.	996·9	0·0	
WS 115	51° 50′ 45″ S, 37° 08′ 00″ W	30 v	2100	—	W	2	W	3	b. c.	1014·4	− 1·4	
WS 116	49° 02′ 00″ S, 35° 06′ 00″ W	31 v	2100	—	SSE	1	—	0	b.	1019·8	2·2	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
111	24	0	0·46	33·87	27·19	—	—	7·71	**N 50 V**	100–0	**2115**			
		10	0·45	33·86	27·17	—	—	7·54	**N 70 V**	50–0				
		20	0·46	33·86	27·17	—	—	7·57	,,	100–50				
		30	0·47	33·86	27·17	—	—	7·64	,,	250–100				
		40	0·47	33·88	27·20	—	—	7·64	,,	500–250				
		50	0·47	33·87	27·19	—	—	7·61	,,	750–500				
		60	0·48	33·87	27·19	—	—	7·66	,,	1000–750	—	**0045**		
		80	0·48	33·86	27·17	—	—	7·64	**N 100 H**	0–5	**1946**	**2016**	1	
		100	0·47	33·91	27·22	—	—	7·64	,,	(100)–50	,,	,,	1	
		150	0·20	34·08	27·37	—	—	6·51	,,	(200)–100	,,	,,	1	
		200	1·02	34·27	27·48	—	—	5·47	**N 70 H**	0–5	**2049**	**2057**	¼	
		300	1·40	34·49	27·62	—	—	4·70	,,	42	,,	,,	¼	
		400	1·89	34·62	27·70	—	—	4·11	,,	84	,,	,,	¼	KT
		500	1·76	34·68	27·75	—	—	4·22						
		750	1·65	34·70	27·78	—	—	4·31						
		1000	1·52	34·70	27·79	—	—	4·29						
		1500	1·07	34·72	27·84	—	—	4·52						
112	25	0	0·90	33·78	27·10	—	—	7·57	**N 50 V**	100–0	1100			
		10	0·93	33·78	27·09	—	—	7·50	**N 70 V**	50–0				
		20	0·93	33·78	27·09	—	—	7·54	,,	100–50				
		30	0·93	33·78	27·09	—	—	7·45	,,	150–100	—	1150		
		40	0·93	33·78	27·09	—	—	7·50	**N 100 H**	0–5	1233	1303	1	
		50	0·93	33·78	27·09	—	—	7·52	,,	73	,,	,,	1	
		60	0·94	33·78	27·09	—	—	7·50	,,	146	,,	,,	1	KT
		80	0·96	33·78	27·09	—	—	7·50	**N 70 H**	0–5	1322	1329	¼	
		100	1·04	33·98	27·25	—	—	6·80	,,	77	,,	,,	¼	
		150	1·10	34·05	27·29	—	—	6·28	,,	154	,,	,,	¼	KT
113	26	0	0·90	33·78	27·10	—	—	7·68	**N 50 V**	100–0	0900			
		10	0·88	33·78	27·10	—	—	7·57	**N 70 V**	50–0				
		20	0·84	33·78	27·10	—	—	7·48	,,	100–50				
		30	0·84	33·78	27·10	—	—	7·59	,,	150–100	—	0945		
		40	0·85	33·78	27·10	—	—	7·64	**N 100 H**	0–5	1015	1045	1	
		50	0·90	33·78	27·10	—	—	7·64	,,	55	,,	,,	1	
		60	1·10	33·80	27·09	—	—	7·23	,,	110	,,	,,	1	KT
		80	1·10	33·82	27·11	—	—	7·14	**N 70 H**	0–5	1103	1111	¼	
		100	1·10	33·81	27·10	—	—	7·04	,,	31(–0)	,,	,,	¼	
		150	1·10	33·87	27·15	—	—	6·93	,,	62	,,	,,	¼	KT
114	26	0	0·90	33·69	27·02	—	—	—	**N 50 V**	100–0	1215			
		10	0·90	33·69	27·02			—	**N 70 V**	50–0				
		20	0·90	33·69	27·02	—	—	—	,,	100–50				
		30	0·90	33·70	27·03	—	—	—	,,	150–100	—	1305		
		40	0·90	33·72	27·04	—	—	—	**N 100 H**	0–5	1321	1351	1	
		50	0·91	33·71	27·04	—	—	—	,,	58	,,	,,	1	
		60	0·93	33·73	27·04	—	—	—	,,	116	,,	,,	1	KT
		80	1·06	33·82	27·12	—	—	—	**N 70 H**	0–5	1411	1419	¼	
		100	1·04	34·00	27·26	—	—	—	,,	58	,,	,,	¼	
		150	1·15	34·11	27·34	—	—	—	,,	116	,,	,,	¼	KT
115	1	—	—	—	—	—	—	—	**N 100 H**	0–5	**2110***	**2140***	1	
									,,	50*	,,	,,	1	
									,,	100*	,,	,,	1	
									N 70 H	0–5	**2200***	**2208***	¼	
									,,	50*	,,	,,	¼	
									,,	100*	,,	,,	¼	
116	2	—	—	—	—	—	—	—	**N 100 H**	0–5	**2110***	**2140***	1	* Approximate times and depths given: actual data lost in storm following station 118
									,,	50*	,,	,,	1	
									,,	100*	,,	,,	1	
									N 70 H	0–5	**2200***	**2208***	¼	
									,,	50*	,,	,,	¼	
									,,	100*	,,	,,	¼	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. °Cent.	Remarks
					Direction	Force	Direction	Force				
WS 117	47° 24′ 15″ S, 30° 19′ 15″ W	1927 1 vi	2105	—	NW	5	NW	5	o.	1017·0	6·4	
WS 118	45° 42′ 45″ S, 25° 08′ 30″ W to 45° 37′ 30″ S, 24° 53′ 00″ W	2–3 vi	0000	—	NW	5	NW	6	o. r.	1010·1	7·8	
WS 119	42° 40′ 30″ S, 17° 46′ 15″ W	5 vi	2103	—	E	3–5	E	6	o.	1005·3	6·67	
WS 120	41° 28′ 15″ S, 13° 54′ 30″ W	6 vi	2104	—	SSW	1	—	0	b. c. p.	1021·0	7·8	
WS 121	40° 31′ 00″ S, 11° 01′ 00″ W	7 vi	1300	2000	NW×N	4	NW×N	4	b. c.	1024·6	11·3	
WS 122	40° 23′ 00″ S, 10° 29′ 00″ W	7–8 vi	2045	2000	W	3–4	—	0	b. c.	1024·4	11·1	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
17	3	—	—	—	—	—	—	—	**N 100 H**	0–5	**2113**	**2143**	1	
									,,	45	,,	,,	1	
									,,	90	,,	,,	1	KT
									N 70 H	0–5	**2203**	**2210**	¼	
									,,	53	,,	,,	¼	
									,,	106	,,	,,	¼	KT
18	4	—	—	—	—	—	—	—	**N 100 H**	0–5	**2134**	**2204**	1	
									,,	68	,,	,,	1	
									,,	137	,,	,,	1	KT
									N 70 H	0–5	**2222**	**2230**	¼	
									,,	66	,,	,,	¼	
									,,	132	,,	,,	¼	KT
									,,	0–5	**2330**	**2340**	⅓	28 consecutive hauls (A–CC) of 10 mins. duration
									,,	0–5	**0410**	**0420**	⅓	
19	6	—	—	—	—	—	—	—	**N 100 H**	0–5	**2110**	**2140**	1	
									,,	100	,,	,,	1	
									,,	200	,,	,,	1	KT
									N 70 H	0–5	**2204**	**2212**	¼	
									,,	97	,,	,,	¼	
									,,	195	**2230**	**2238**	¼	KT
20	7	—	—	—	—	—	—	—	**N 100 H**	0–5	**2111**	**2141**	1	
									,,	50	,,	,,	1	
									,,	101	,,	,,	1	KT
									N 70 H	0–5	**2159**	**2207**	¼	
									,,	53	,,	,,	¼	
									,,	106	,,	,,	¼	KT
21	8	0	11·59	—	—	—	—	5·61	**N 50 V**	100–0	1300			
		10	11·59	34·60	26·37	—	—	5·61	**N 70 V**	50–0				
		20	11·59	34·60	26·37	—	—	5·65	,,	100–50				
		30	11·60	34·60	26·37	—	—	5·68	,,	250–100				
		40	11·60	34·65	26·41	—	—	5·64	,,	500–250				
		50	11·60	—	—	—	—	5·56	,,	750–420				
		60	11·60	34·56	26·34	—	—	5·61	,,	1000–0				
		80	11·60	—	—	—	—	5·60	,,	1000–700	—	**1700**		
		100	11·58	34·54	26·33	—	—	5·63	**N 100 H**	0–5	**1718**	**1748**	1	
		150	9·88	34·79	26·83	—	—	5·90	,,	50	,,	,,	1	
		200	9·64	34·80	26·88	—	—	5·38	,,	101	,,	,,	1	KT
		300	8·69	—	—	—	—	5·47	**N 70 H**	0–5	**1810**	**1818**	¼	
		400	7·54	34·50	26·96	—	—	5·22	,,	59	,,	,,	¼	
		500	6·30	34·49	27·13	—	—	4·96	,,	119	,,	,,	¼	KT
		750	4·74	34·18	27·08									
		1000	3·55	—	—	—	—	5·16						
		1500	2·68	34·39	27·45	—	—	5·13						
22	8	0	11·59	34·47	26·27	—	—	—	**N 50 V**	100–0	**2045**			
		10	11·63	—	—	—	—	—	**N 70 V**	50–0				
		20	11·61	—	—	—	—	—	,,	100–50				
		30	11·64	34·52	26·30	—	—	—	,,	250–100				
		40	11·65	34·56	26·33	—	—	—	,,	500–250				
		50	11·67	34·58	26·34	—	—	—	,,	750–500				
		60	11·67	34·58	26·34	—	—	—	,,	1000–750	—	**2345**		
		80	11·69	34·61	26·37	—	—	—	**N 100 H**	0–5	**0016**	**0046**	1	
		100	11·69	34·60	26·35	—	—	—	,,	50	,,	,,	1	
		150	9·89	34·74	26·43	—	—	—	,,	101	,,	,,	1	KT
		200	9·52	34·76	26·51	—	—	—	**N 70 H**	0–5	**0111**	**0119**	¼	
		300	8·84	34·56	26·72	—	—	—	,,	52	,,	,,	¼	
		400	6·68	34·40	27·01	—	—	—	,,	104	,,	,,	¼	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 122 *cont.*	40° 23′ 00″ S, 10° 29′ 00″ W	1927 7–8 vi										
WS 123	Gough I	8–9 vi										
WS 124	Gough I, Penguin I anchorage, 40° 16′ S, 9° 58′ W	9 vi	1824	40–60	NW	1	—	0	b. c.	1025·2	10·0	
WS 125	40° 14′ 45″ S, 10° 15′ 00″ W	9 vi	0715	2500	NW	1	—	0	b. c.	1025·2	10·0	
WS 126	40° 23′ 00″ S, 10° 15′ 00″ W	10 vi	0700	1500	NW	5	NW	3	b. c. p.	1022·4	9·4	
WS 127	40° 19′ 00″ S, 10° 06′ 00″ W	10 vi	1200	940 gl. oz.	NW	4	NW	4	o.	1020·2	10·5	
WS 128	West side of Gough I, inshore 40° 19′ 00″ S, 10° 04′ 00″ W	10 vi	1615	120–90	NW	4	NW	3	o.	1017·3	11·9	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
WS 122		500	5·48	34·34	27·12									
mt.		750	4·11	34·22	27·17									
		1000	3·18	34·20	27·25									
		1500	2·66	34·50	27·53									
WS 123	9	—	—	—	—	—	—	—	**Sh. coll.**					
WS 124	10	—	—	—	—	—	—	—	**DLH**	40–60	**1824**	**1833**		
WS 125	10	0	11·63	—	—	—	—	—	**N 50 V**	100–0	**1915**			
		10	11·61	34·56	26·33	—	—	—	**N 70 V**	50–0				
		20	11·59	34·56	26·34	—	—	—	,,	100–50				
		30	11·59	34·56	26·34	—	—	—	,,	250–100				
		40	11·58	34·56	26·34	—	—	—	,,	500–250				
		50	11·58	34·56	26·34	—	—	—	,,	750–500				
		60	11·55	34·58	26·37	—	—	—	,,	1000–750	—	**2220**		
		80	11·53	34·45?	26·26?	—	—	—	**N 100 H**	0–5	**2247**	**2317**	1	
		100	11·49	34·58	26·38	—	—	—	,,	82	,,	,,	1	
		150	10·99	34·54	26·44	—	—	—	,,	165(–82)	,,	,,	1	KT
		200	9·57	34·60	26·73	—	—	—	**N 70 H**	0–5	**2347**	**2355**	¼	
		300	7·97	34·49	26·89	—	—	—	,,	70	,,	,,	¼	
		400	6·48	34·43	27·06	—	—	—	,,	139	,,	,,	¼	KT
		500	5·48	34·31	27·09									
		750	3·81	34·20	27·19									
		1000	2·98	34·22	27·28									
		1500	2·66	34·52	27·55									
WS 126	11	0	11·79	34·56	26·30	—	—	—	**N 50 V**	100–0	**0700**			
		10	11·79	34·56	26·30	—	—	—	**N 70 V**	50–0				
		20	11·79	34·56	26·30	—	—	—	,,	100–50				
		30	11·79	34·56	26·30	—	—	—	,,	250–100				
		40	11·79	34·56	26·30	—	—	—	,,	500–250				
		50	11·79	34·56	26·30	—	—	—	,,	750–500				
		60	11·79	34·56	26·30	—	—	—	,,	1000–750	—	0940		
		80	11·75	34·59	26·33	—	—	—	**N 100 H**	0–5	1003	1033	1	
		100	11·70	34·65	26·39	—	—	—	,,	91	,,	,,	1	
		150	9·69	34·67	26·76	—	—	—	,,	183	,,	,,	1	KT
		200	9·19	34·67	26·85	—	—	—	**N 70 H**	0–5	1049	1057	¼	
		300	8·06	34·49	26·88	—	—	—	,,	73	,,	,,	¼	
		400	6·68	34·34	26·97	—	—	—	,,	146	,,	,,	¼	KT
		500	5·09	34·22	27·06									
		750	3·68	34·14	27·16									
		1000	2·97	34·25	27·31									
		1500	2·66	34·58	27·60									
WS 127	11	0	11·74	34·52	26·29	—	—	5·75	**N 50 V**	100–0	1200			
		10	11·71	34·58	26·34	—	—	5·60	**N 70 V**	50–0				
		20	11·69	34·58	26·34	—	—	5·61	,,	100–50				
		30	11·69	34·58	26·34	—	—	5·65	,,	250–100				
		40	11·69	34·58	26·34	—	—	7·31?	,,	500–250				
		50	11·69	34·58	26·34	—	—	5·72	,,	750–450				
		60	11·69	34·58	26·34	—	—	5·60	,,	1000–650	—	1430		
		80	11·67	34·58	26·34	—	—	5·60	**N 100 H**	0–5	1452	1522	1	
		100	11·60	34·58	26·36	—	—	5·54	,,	87	,,	,,	1	
		150	11·04	34·63	26·50	—	—	5·35	,,	174	,,	,,	1	KT. Physical observations at 500, and 850 unreliable
		200	9·79	34·69	26·76	—	—	5·36	**N 70 H**	0–5	1541	1549	¼	
		300	8·49	34·58	26·89	—	—	5·28	,,	87	,,	,,	¼	
		500	7·01	34·30	26·89	—	—	5·14	,,	174	,,	,,	¼	KT
		850	3·88	34·22	27·19	—	—	5·28						
WS 128	11	—	—	—	—	—	—	—	**DLH**	120–90	1626	1636		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remarks
					Direction	Force	Direction	Force				
WS 129	40° 10′ 30″ S, 9° 40′ 45″ W	1927 11 vi	0715	1500	WNW	4–5	WNW	4	b. c.	1015·5	11·6	
WS 130	40° 06′ 00″ S, 9° 22′ 00″ W	11 vi	1255	1500	NW×W	4–5	NW×W	5	o. r.	1013·6	11·1	
WS 131	39° 35′ 00″ S, 3° 33′ 15″ W	12 vi	2126	—	SW	3–4	SW	4	o. p.	1019·8	9·4	
WS 132	38° 21′ 30″ S, 0° 37′ 15″ E	13 vi	2102	—	E × S	1	—	0	b. c.	1031·8	8·3	
WS 133	37° 49′ 30″ S, 5° 01′ 45″ E to 37° 38′ 45″ S, 5° 50′ 00″ E	14–15 vi	2105	—	NW	3–4	NW	4–5	b. c.	1028·3	14·4	
WS 134	36° 57′ 00″ S, 8° 44′ 30″ E	15 vi	2115	—	NW	4	NW	2	b. c.	1027·6	13·8	

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S ‰	σt	pH	P_2O_5 mgm. p.m.^{3}	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
9	12	0	11·65	34·58	26·35	—	—	—	**N 50 V**	100–0	**0715**			
		10	11·59	34·58	26·36	—	—	5·60	**N 70 V**	50–0				
		20	11·59	34·52	26·31	—	—	5·59	,,	100–50				
		30	11·59	34·51	26·30	—	—	5·62	,,	250–100				
		40	11·59	34·51	26·30	—	—	5·65	,,	500–250				
		50	11·59	34·53	26·32	—	—	5·59	,,	750–500				
		60	11·59	34·56	26·34	—	—	5·58	,,	1000–750	—	0945	1	
		80	11·59	34·56	26·34	—	—	5·60	**N 100 H**	0–5	1023	1053	1	
		100	11·50	34·64	26·42	—	—	5·44	,,	50	,,	,,	1	KT
		150	10·48	34·65	26·61	—	—	5·33	,,	99(–50)	,,	,,	¼	
		200	10·39	34·83	26·77	—	—	5·23	**N 70 H**	0–5	1121	1129	¼	
		300	8·27	34·54	26·90	—	—	5·27	,,	55	,,	,,	¼	KT
		400	6·21	34·34	27·03	—	—	5·08	,,	110	,,	,,		
		500	5·48	34·25	27·04	—	—	5·16						
		750	3·88	34·22	27·19									
		1000	3·05	34·22	27·28	—	—	4·82						
		1500	2·66	34·43	27·48	—	—	3·80						
10	12	0	12·09	34·63	26·30	—	—	—	**N 50 V**	100–0	1255			
		10	12·10	34·65	26·31	—	—	—	**N 70 V**	50–0				
		20	12·10	34·66	26·32	—	—	—	,,	100–50				
		30	12·09	34·66	26·32	—	—	—	,,	250–100				
		40	12·09	34·63	26·30	—	—	—	,,	500–250				
		50	12·09	34·63	26·30	—	—	—	,,	750–500				
		60	12·09	34·62	26·30	—	—	—	,,	1000–750	—	1510		
		80	12·09	34·62	26·30	—	—	—	**N 100 H**	0–5	1529	1559	1	
		100	12·09	34·66	26·32	—	—	—	,,	52	,,	,,	1	
		150	10·71	34·87	26·74	—	—	—	,,	104	,,	,,	1	KT
		200	10·51	34·81	26·80	—	—	—	**N 70 H**	0–5	1621	1629	¼	
		300	8·69	34·63	26·90	—	—	—	,,	60	,,	,,	¼	
		400	7·06	34·43	26·98	—	—	—	,,	120	,,	,,	¼	KT
		500	5·48	34·43	27·19									
		750	4·46	34·21	27·13									
		1000	3·27	34·23	27·27									
		1500	2·66	34·40	27·46									
31	12	—	—	—	—	—	—	—	**N 100 H**	0–5	**2126**	**2156**	1	
									,,	46	,,	,,	1	
									,,	92	,,	,,	1	KT
									N 70 H	0–5	**2223**	**2231**	¼	
									,,	56	,,	,,	¼	
									,,	112	,,	,,	¼	KT
32	13	—	—	—	—	—	—	—	**N 100 H**	0–5	**2108**	**2138**	1	
									,,	73	,,	,,	1	
									,,	146	,,	,,	1	KT
									N 70 H	0–5	**2159**	**2207**	¼	
									,,	77	,,	,,	¼	
									,,	155	,,	,,	¼	KT
33	14	—	—	—	—	—	—	—	**N 100 H**	0–5	**2112**	**2142**	1	
									,,	50	,,	,,	1	
									,,	99	,,	,,	1	KT
									N 70 H	0–5	**2200**	**2208**	¼	
									,,	57	,,	,,	¼	
									,,	115	,,	,,	¼	KT
									,,	0–5	**2230** /	**2240** /	⅛	57 consecutive hauls (A–GGG) of 10 mins. duration. Sunrise 0705
									,,	0–5	0750	0800	⅛	
34	15	—	—	—	—	—	—	—	**N 100 H**	0–5	**2121**	**2151**	1	
									,,	62	,,	,,	1	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° Cent.	Remark
					Direction	Force	Direction	Force				
WS 134 *cont.*	36° 57′ 00″ S, 8° 44′ 30″ E	1927 15 vi										
WS 135	35° 29′ 45″ S, 13° 04′ 45″ E	16 vi	2109	—	var.	1	—	0	b. c. p.	1031·0	13·3	
WS 136	34° 16′ 15″ S, 17° 15′ 15″ E	17 vi	2108	—	ESE	2–3	ESE	2–1	b.	1020·4	16·6	

	Age of moon (days)	HYDROLOGICAL OBSERVATIONS							BIOLOGICAL OBSERVATIONS					Remarks
		Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	pH	P_2O_5 mgm. p.m.³	O_2 cc. p.l.	Gear	Depth (metres)	TIME Shot	TIME Hauled	Length of tow (miles)	
34									**N 100 H**	124	**2121**	**2151**	1	KT
									N 70 H	0–5	**2213**	**2221**	¼	
									,,	55	,,	,,	¼	
									,,	111	,,	,,	¼	KT
									N 100 B	126–0	**2241**	**2301**		
									N 70 B	123–0	,,	,,		KT
35	16	—	—	—	—	—	—	—	**N 100 H**	0–5	**2115**	**2145**	1	
									,,	62	,,	,,	1	
									,,	124(–62)	,,	,,	1	KT
									N 70 H	0–5	**2216**	**2224**	¼	
									,,	62	,,	,,	¼	
									,,	124	,,	,,	¼	KT
36	17			—	—	—	—		**N 100 H**	0–5	**2114**	**2144**	1	
									,,	55	,,	,,	1	
									,,	110	,,	,,	1	KT
									N 70 H	0–5	**2207**	**2215**	¼	
									,,	85	,,	,,	¼	
									,,	171	,,	,,	¼	KT

Station	Position	Date	WIND		Sea	Weather	Moon (age in days)
			Direction	Force			
	S Georgia	1925					
MS 1	1 cable SSE of Hope Pt, E Cumberland Bay	11 ii	—	0	0	o.	18
MS 2	2½ cables E of Hope Pt, E Cumberland Bay	11 ii	—	0	0	o.	18
MS 3	E Cumberland Bay. ¾ mile SE × S of Hope Pt, to ½ mile SE of Hobart Rk	11 ii	—	0	0	o.	18
MS 4	½ mile SE of Hobart Rk, E Cumberland Bay	11 ii	—	0	0	o.	18
MS 5	E Cumberland Bay. 2 cables S of Hope Pt to 1¼ cables S × E of King Edward Pt Lt	11 ii	—	0	0	o.	18
MS 6	E Cumberland Bay. ¼ mile S of Hope Pt to 1¼ cables S × E of King Edward Pt Lt	12 ii	NW	3	0	o.	19
MS 7	¼ mile SW of Hope Pt, E Cumberland Bay	12 ii	NW	3	0	—	19
MS 8	E Cumberland Bay. ½ mile E to 1·8 miles E × S of Hope Pt	14 ii	NW	0	3	o. s. q.	20
MS 9	1·8 miles E × S of Hope Pt, E Cumberland Bay	14 ii	NW	0	3	o. s. q.	20
MS 10	E Cumberland Bay. ¼ mile SE of Hope Pt to ¼ mile S of Govt Flagstaff	14 ii	NW	0	3	o. s. q.	20
MS 11	¼ mile SSW of Hope Pt, E Cumberland Bay	14 ii	NW	0	3	o. s. q.	20
MS 12	E Cumberland Bay. 1 cable E to 1 mile S × E ½ E of Hobart Rk	17 ii	—	0	0	b. c.	23
MS 13	1¼ miles SSE of Hope Pt, E Cumberland Bay	17 ii	—	0	0	b. c.	23
MS 14	From 1·5 miles SE × S to 1·5 miles S ½ W of Sappho Pt, E Cumberland Bay	17 ii	—	0	0	b. c.	23
MS 15	E Cumberland Bay. 3 miles SW of Merton Rk to 2¼ miles NNW of Dartmouth Pt	17 ii	—	0	0	b. c.	23
MS 16	3 miles SW of Merton Rk, E Cumberland Bay	17 ii	—	0	0	b. c.	23
MS 19	3 miles SW of Merton Rk, E Cumberland Bay	9 iv	—	0	0	b. c.	14
MS 20	1¼ miles SW × W of Merton Rk, E Cumberland Bay	9 iv	—	0	3	o.	14
MS 21	2¾ miles N of Macmahon Rk, E Cumberland Bay	9 iv	—	0	3	o.	14
MS 22	1·3 miles N of Dartmouth Pt, E Cumberland Bay	9 iv	—	0	3	o.	14
MS 23	1¼ miles SW × W of Merton Rk, E Cumberland Bay	12 iv	—	0	3	b. c.	17
MS 24	E Cumberland Bay. ½ cable SE of Hope Pt to 4 cables S × E of Hobart Rk	13 iv	—	0	0	b. c.	18
MS 25	E Cumberland Bay. 4½ cables NE to 1¼ cables N × W of Hobart Rk	13 iv	—	0	0	b. c.	18
MS 26	E Cumberland Bay. (A) 3¼ miles SSW of Merton Rk to 4½ cables NE of Hobart Rk. (B) 4½ cables NE to 1¼ cables N × W of Hobart Rk	15 iv	—	0	4	o.	20
MS 27	1¼ miles SW × W of Merton Rk, E Cumberland Bay	29 iv	—	0	2	b. c.	6
MS 28	1¼ miles E of Hobart Rk, E Cumberland Bay	30 iv	—	0	2	b. c.	7

Station	HYDROLOGICAL OBSERVATIONS				BIOLOGICAL OBSERVATIONS				Remarks
	Depth (metres)	Temp. ° Cent.	S ‰	σt	Gear	Depth (metres)	TIME Shot	TIME Hauled	
MS 1	—	—	—	—	**NC 50 H**	15	1730	1745	
MS 2	—	—	—	—	**NC 50 H**	15	1750	1805	
MS 3	—	—	—	—	**DS**	70	1810	1830	
MS 4	—	—	—	—	**NC 50 H**	15	1820	1830	
MS 5	—	—	—	—	**DS**	30–20	1850	1910	
MS 6	—	—	—	—	**BTS**	24–30	1915	1935	
MS 7	0	5·57	30·95	—	**NC 50 H**	15	1925	1935	
MS 8	—	—	—	—	**BTS**	70–?	1545	1630	trawl did not reach bottom
MS 9	0	3·57	32·39	—	**NC 50 H**	0	1615	1625	
MS 10	—	—	—	—	**BTS**	26–18	1720	1740	
MS 11	—	—	—	—	**NC 50 H**	9	1730	1740	
MS 12	—	—	—	—	**BTS**	25–60	1545	1630	
MS 13	—	—	—	—	**NC 50 V**	35–0	1630		
MS 14	—	—	—	—	**DS**	190–110	1730	1800	a little glacier ice
MS 15	—	—	—	—	**DS**	110	1830	1900	
MS 16	—	—	—	—	**NC 50 V**	40–0	1815		
MS 19	—	—	—	—	**NC 50 V**	160–0	1100		
					,,	120–80			
					,,	80–40	—	1200	
MS 20	0	2·50	33·17	—	**NC 50 V**	200–160	1430		
					,,	40–0			
MS 21	0	2·00	32·41	—	**NC 50 V**	40–0	1530		
MS 22	0	2·07	32·30	—	**NC 50 V**	40–0	1605		
MS 23	0	2·42	33·21	26·53	**NC 50 V**	40–0	1215		
	40	2·39	33·80	27·00	,,	80–40			
	80	2·30	33·98	27·16	,,	120–80			
	120	2·26	33·86	27·05	,,	160–120			
	160	1·84	33·98	27·19	,,	220–160	–	1445	
MS 24	—	—		—	**BTS**	30	1530	1600	
					NC 50 H	10	1545	1555	
MS 25	—	—	—	—	**BTS**	36	1800	1825	
					NC 50 H	10	1815	1825	
MS 26	—	—	—		**NC 50 H**	10	1745	1800	A
					,,	10	1805	1815	B
MS 27	0	1·56	31·59	25·30	**NC 50 V**	40–0	1300	—	some glacier ice
	40	2·18	33·82	27·04	,,	80–40			
	80	2·13	33·84	27·05	,,	120–80			
	120	2·10	33·78	27·01	,,	160–120			
	160	1·76	33·87	27·14	,,	200–160		1700	
MS 28	0	1·22	26·69	—	**NC 50 V**	40–0	1130		

Station	Position	Date	WIND		Sea	Weather	Moon (age in days)
			Direction	Force			
	S Georgia	1925					
MS 29	1¼ miles N of Dartmouth Pt, E Cumberland Bay	30 iv	–	0	2	b. c.	7
MS 30	¾ mile NE × E of Macmahon Rk, E Cumberland Bay	30 iv	—	0	3	o.	7
MS 31	2 miles N ½ E of Macmahon Rk, E Cumberland Bay	30 iv	—	0	3	o.	7
MS 32	E Cumberland Bay. 4½ cables NE of Hobart Rk to 1½ miles SSE of Hope Pt	1 v	—	0	2	b. c.	8
MS 33	1 cable E of Hobart Rk, E Cumberland Bay	1 v	—	0	2	b. c.	8
MS 34	E Cumberland Bay. (A) 3¼ miles SSW of Merton Rk to 4½ cables NE of Hobart Rk. (B) 4½ cables NE of Hobart Rk to ½ cable S of Hope Pt	2 v	—	0	3	b. c.	9
MS 35	Coal Harbour	3 ix	NW	6	3	o.	16
MS 36	Wilson Harbour	5 ix	E	8	0	o.	18
MS 36B	King Haakon Bay	14 x	—	0	3	o.	26
MS 37	King Haakon Bay	15 x	—	0	4	o.	27
MS 38	King Haakon Bay to Wilson Harbour	15 x	WNW	8	4	o.	27
MS 39	King Haakon Bay to 3 miles S of Undine Harbour	25 x	—	0	3	o.	9
MS 40	¾ mile S of C Pariadin to 5 miles W of Welcome I	25 x	—	0	0	f.	9
MS 41	2 miles NE of C Saunders to 2 miles N of C Constance	26 x	—	0	0	b. c.	10
MS 42	2 miles N of C Constance to ¼ mile S of Welcome I	26 x	—	0	0	b. c.	10
MS 43	¼ mile S of Welcome I to ½ mile N of Else Bay	26 x	—	0	0	b. c.	10
MS 44 to MS 61	Chemical observations, S.S. *Fleurus*, between S Georgia and Falkland Is						
		1926					
MS 62	E Cumberland Bay. ½ cable E to 3¾ cables S of Hobart Rk	24 ii	—	0	0	b. c.	13
MS 63	E Cumberland Bay. 1·3 miles S × E to 1·6 miles SE × S of Hope Pt	24 ii	—	0	0	—	13
MS 64	1·8 miles SE × S of King Edward Pt Lt, E Cumberland Bay	24 ii	—	0	0	b. c.	13
MS 65	E Cumberland Bay. 1·6 miles SE of Hobart Rk to 1 cable N of Dartmouth Pt	28 ii	N	2	2	b. c.	16
MS 66	E Cumberland Bay. 2¼ miles SE of King Edward Pt Lt to 1½ cables W × N of Macmahon Rk	28 ii	N	2	2	b. c.	16
MS 67	E Cumberland Bay. 3 cables NE of Hobart Rk to ½ cable W of Hope Pt	28 ii	N	2	2	b. c.	16
MS 68	E Cumberland Bay. 1·7 miles S ½ E to 8½ cables SE × E of Sappho Pt	2 iii	—	0	0	f. r.	17

Station	HYDROLOGICAL OBSERVATIONS				BIOLOGICAL OBSERVATIONS				Remarks
	Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	Gear	Depth (metres)	TIME		
							Shot	Hauled	
MS 29	0	1·20	30·37	—	**NC 50 V**	40–0	1215		
MS 30	0	0·87	30·82	—	**NC 50 V**	40–0	1300	—	much glacier ice
MS 31	0	1·77	31·56	—	**NC 50 V**	40–0	1345		
MS 32	—	—	—	—	**BTS**	40	1545	1650	
					NC 50 H	0–5	1555	1610	
					,,	0–5	1610	1625	
MS 33	—	—	—	—	**BTS**	40	**1700**	**1710**	trawl hitched
MS 34	—	—	—	—	**NC 50 H**	20	1210	1225	A. Much glacier ice
					,,	20	1225	1240	B
MS 35	—	—	—	—	**NC 50 V**	20–0	0930		
MS 36	—	—	—	—	**NC 50 H**	0	1615	1625	
MS 36 B	—	—	—	—	**NHS**	0	1730	1745	
MS 37	—	—	—	—	**NHS**	0	1500	1615	
MS 38	—	—	—	—	**NHS**	0	1800	**1940**	
MS 39	—	—	—	—	**NHS**	0	1645	1855	
MS 40	—	—	—	—	**NHS**	0	**1905**	**2115**	
MS 41	—	—	—	—	**NHS**	0	1615	1815	
MS 42	—	—	—	—	**NHS**	0	1830	**2015**	
MS 43	—	—	—	—	**NHS**	0	**2020**	**2200**	
MS 62	—	—	—	—	**BTS**	31	1000	1030	some glacier ice
					N 70 H	0–5	1018	1028	
MS 63	0	3·62	—	—	**BTS**	23	1045	1115	
MS 64	—	—	—	—	**DS**	7–15	1120	1125	
					,,	7–15	1135	1140	
MS 65	—	—	—	—	**BTS**	39	1030	1045	trawl hitched
					NCS–T				
					N 70 H	0–5	1035	1045	
MS 66	—	—	—	—	**BTS**	18	1058	1115	
					NCS–T				
MS 67	—	—	—	—	**BTS**	38	1215	1237	
					NCS–T				
MS 68	0	2·89	31·87	25·43	**NRL**	220–247	1050	1110	
	5	2·64	33·40	26·66	**NCS–N**				
	10	2·83	33·68	26·86					
	20	2·92	33·80	26·96					
	30	2·90	33·89	27·03					
	40	2·82	33·91	27·05					
	50	2·73	33·77	26·94					
	75	2·71	33·73	26·91					
	100	2·43	33·80	27·00					

Station	Position	Date	WIND		Sea	Weather	Moon (age in days)
			Direction	Force			
	S Georgia	1926					
MS 68 *cont.*		2 iii					
MS 69	E Cumberland Bay. 1½ cables E × N to 8½ cables E × N of Macmahon Rk	5 iii	—	0	2	b. c.	20
MS 70	Maiviken, W Cumberland Bay	9 iii	—	0	0	b. c.	24
MS 71	E Cumberland Bay. 9¼ cables E × S to 1·2 miles E × S of Sappho Pt	9 iii		0	2	b. c.	24
MS 72	1·4 miles SE of Sappho Pt, E Cumberland Bay	9 iii	—	0	2	b. c.	24
MS 73	(omitted)						
MS 74	E Cumberland Bay. 1 cable SE × E of Hope Pt to 3·1 miles SW of Merton Rk	17 iii	—	0	2	o.	4
	Saldanha Bay, S Africa						
MS 75	South side of Riet Bay	11 viii	—	0	0	b. c.	4
MS 76	South side of Riet Bay	12 viii	—	0	0	o.	5
MS 77	Between Whaling St and Meuuw I	12 viii	—	0	0	o.	5
MS 78	Between Meuuw I and Schapen I	17 viii	SW	0	0	b. c.	9
MS 79	Across Riet Bay	22 viii	—	0	0	b. c.	14
MS 80	NW of Meuuw I	6 ix	—	0	0	b. c.	28
MS 81	1 mile W of Salamander Whaling St	6 ix	—	0	1	b. c.	28
MS 82	Off Salamander Pt	6 ix	—	0	0	b. c.	28

Station	HYDROLOGICAL OBSERVATIONS				BIOLOGICAL OBSERVATIONS				Remarks
	Depth (metres)	Temp. ° Cent.	S °/₀₀	σt	Gear	Depth (metres)	TIME Shot	TIME Hauled	
MS 68	150	2·15	33·86	27·06					
cont.	220	0·76	33·96	27·24					
MS 69	—	—	—	—	**DS**	146	1800	1830	
MS 70	—	—	—	—	**Sh. coll.**				
MS 71	—	—	—	—	**BTS**	110–60	1500	1535	
					NCS–T				
MS 72	0	2·65	32·54	25·97					
	5	2·61	33·26	26·55					
	10	3·00	33·58	26·78					
	15	3·15	33·66	26·82					
	20	3·15	33·66	26·82					
	30	3·06	33·68	26·84					
	40	3·02	33·62	26·81					
	50	3·00	33·68	26·85					
	75	2·96	33·82	26·97					
	100	2·62	33·89	27·05					
	150	0·91	34·04	27·30					
MS 74	35	2·75	33·82	—	**BTS**	22–40	1430	1500	
					NCS–T				
MS 75	—	—	—	—	**HH**				
MS 76	—	—	—	—	**HH**				
MS 77	—	—	—	—	**LH**				
MS 78	—	—	—	—	**N 50 H**	0	1500	1510	
MS 79	—	—	—	—	**N 50 H**	0			
MS 80	—	—	—	—	**BTS**	4–10	1412	1427	
MS 81	—	—	—	—	**BTS**	8–10	1453	1508	
					N 50 H	0–4	1453	1500	
MS 82	—	—	—	—	**BTS**	7–14			

SUMMARISED LIST OF STATIONS

The positions of all stations made by the R.R.S. 'Discovery' and R.S.S. 'William Scoresby' in 1925–27 are shown on the charts reproduced in Plates I–V. The following lists indicate on which chart each of the stations is to be found. Plate VI is a map of South Georgia on which the place names in the list of MS stations are entered.

R.R.S. 'DISCOVERY'

Station	Date	Place	Plate
1, 2	16, 17. xi. 25	Ascension Island	
3	3. xii. 25	Mid South Atlantic	I
4–6	30. i.–1. ii. 26	Tristan da Cunha	I
7–12	3–18. ii. 26	Tristan da Cunha to South Georgia	I
13–45	3. iii.–6. iv. 26	Off South Georgia	II
46, 47	21, 23. iv. 26	South Georgia to Falkland Islands	I
48–58	3–19. v. 26	Off Falkland Islands	IV
59–89	20. v.–28. vi. 26	Falkland Islands to Cape Town	I, V
90–101	10. vii.–14. x. 26	Off South-west Africa	V
102–116	28. x.–14. xi. 26	South Africa to Bouvet Island	I
117–121	17–25. xi. 26	Bouvet Island to South Georgia	I
122–159	14. xii. 26–21. i. 27	Off South Georgia	II
160, 161	7, 14. ii. 27	South Georgia to South Orkneys	I
162–167	17–20. ii. 27	Off South Orkneys	I
168–170	21–23. ii. 27	South Orkneys to South Shetlands	I
171–177	25. ii.–5. iii. 27	Bransfield Strait, South Shetlands	III
178–192	9–27. iii. 27	Palmer Archipelago	III
193–209	28. iii.–14. iv. 27	Bransfield Strait, South Shetlands	III
210–221	14–22. iv. 27	Drake Strait	I
222–230	23. iv.–5. v. 27	Cape Horn to Falkland Islands	I
231–259	28. v.–26. vi. 27	Falkland Islands to Cape Town	I, V
260–265	19–20. vii. 27	Off South-west Africa	V
266–299	21. vii.–4. ix. 27	Cape Town to Cape Verde Islands	V

R.S.S. 'WILLIAM SCORESBY'

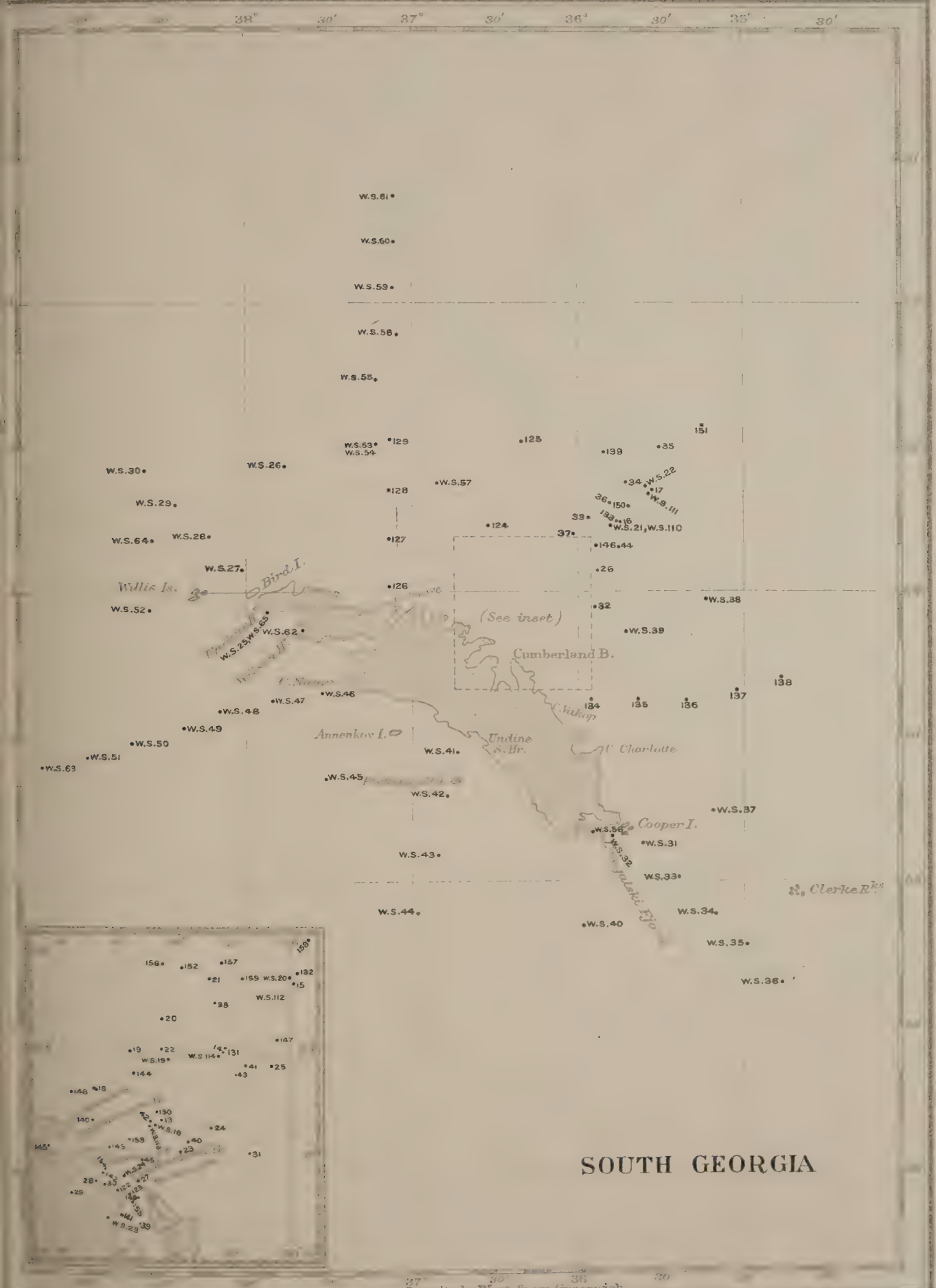
Station	Date	Place	Plate
WS 1–4	25. viii.–30. ix. 26	Off South-west Africa	I, V
WS 5–17	22. x.–5. xi. 26	Cape Town to South Georgia	I
WS 18–65	26. xi. 26–22. i. 27	Off South Georgia	II
WS 66–70	18–23. ii. 27	South Georgia to Falkland Islands	I
WS 71–99	23. ii.–19. iv. 27	Off Falkland Islands and between Falkland Islands and South America	IV
WS 100–107	23–25. iv. 27	Falkland Islands to Port Desire, South America	I
WS 108, 109	25, 26. iv. 27	North of Falkland Islands	IV
WS 110–114	26–28. v. 27	Off South Georgia	II
WS 115–121	30. v.–7. vi. 27	South Georgia to Gough Island	I
WS 122–130	7–11. vi. 27	Off Gough Island	I
WS 131–136	12–17. vi. 27	Gough Island to Cape Town	I, V

PLATES I—VI

SOUTH
W.S.118
W.S.117
W.S.116
W.S.115
W.S.18
W.S.17
W.S.107
W.S.106
W.S.105
W.S.104
W.S.103
W.S.102
W.S.101
W.S.100
W.S.70
W.S.69
W.S.68
W.S.67
W.S.163
South Georgia
South Orkneys
STRAIT
77
76
75
74
73
72
71
70
69
68
67
66
65
64
63
62
61
60
59
48
47
244
243
242
241
240
239
238
237
236
235
234
233
232
231
230
229
228
227
226
225
224
223
222
221
220
218,219
217
216
215
214
213
212
211
210
12
11
10
161
160
153,164,165,166,
162,167
169
168
170
171

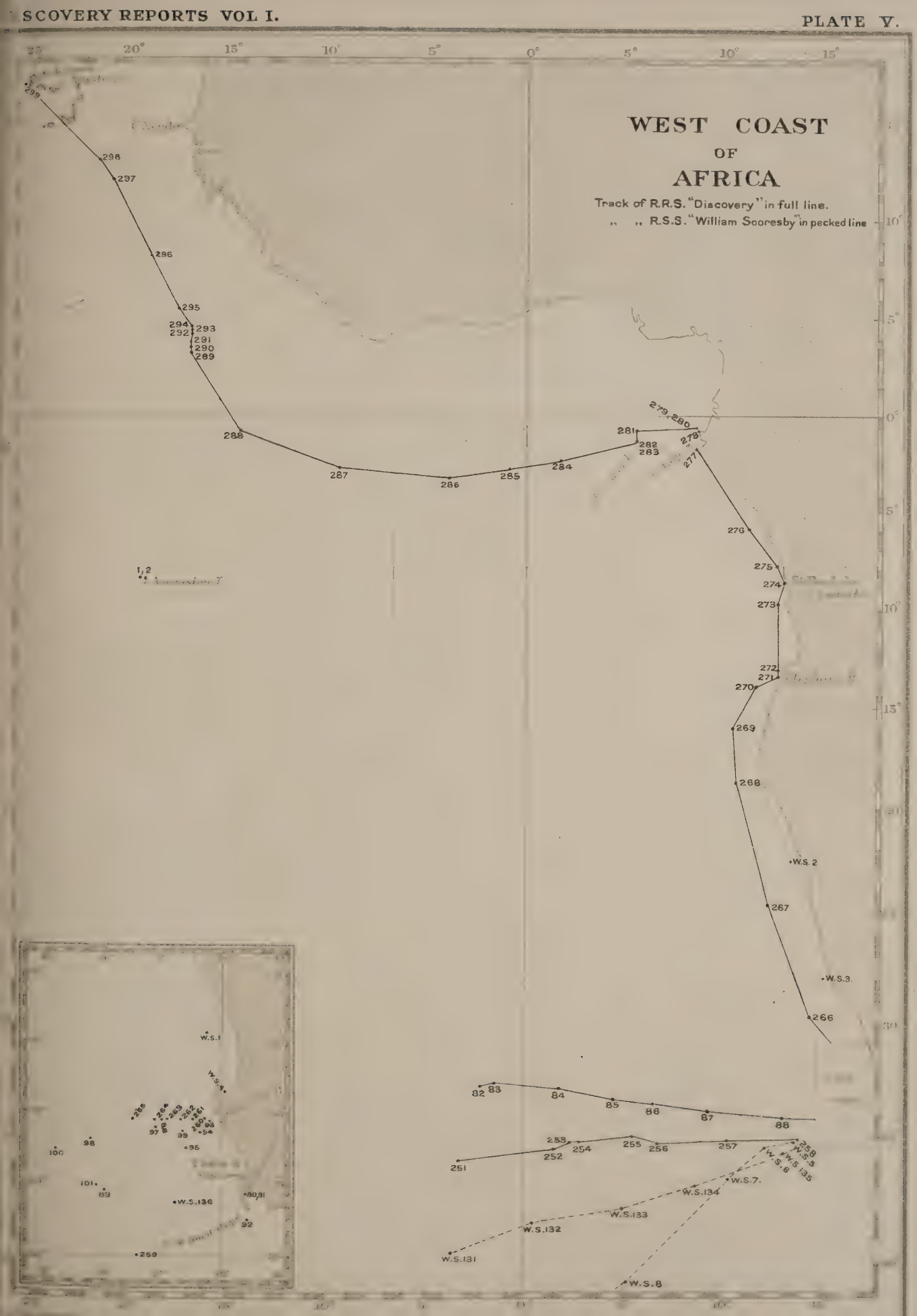
SOUTH ATLANTIC
AND
SOUTHERN OCEANS

Track of R.R.S. "Discovery" in full line.
" " R.S.S. "William Scoresby" in pecked line.


38° 30′ 37° 30′ 36° 30′ 35° 30′
W.S.61
W.S.60
W.S.59
W.S.58
W.S.55
W.S.53
W.S.54
W.S.30
W.S.26
W.S.29
W.S.64
W.S.28
W.S.27
Willis Is.
Bird I.
W.S.52
W.S.25
W.S.65
W.S.62
W.S.57
W.S.22
W.S.111
W.S.21
W.S.110
W.S.38
W.S.39
(See inset)
Cumberland B.
W.S.46
W.S.47
W.S.48
W.S.49
W.S.50
W.S.51
W.S.63
Annenkov I.
Undine Hr.
W.S.41
C. Charlotte
W.S.45
W.S.42
W.S.43
W.S.44
W.S.56
Cooper I.
W.S.31
W.S.32
W.S.33
W.S.37
W.S.34
W.S.40
W.S.35
W.S.36
Clerke Rks
129
125
139
35
151
128
124
127
126
146
44
26
32
34
17
150
16
37
36
33
138
137
135
136
134
SOUTH GEORGIA
Longitude West from Greenwich.
37° 30′ 36 30

SOUTH
SHETLANDS
Livingston I.
South I.
Greenwich I.
Nelson I.
Robertson I.
Deception I.
Smith I.
Low I.
Elephant I.
Clarence I.
Gibbs I.
Joinville I.
Dundee I.
Paulet I.
Brown Bluff
Cape Legoupil
Cape Lamaire
Cape Sterneck
Cape Seymour
Cape Wallace
Cape Saunders
Cape Dundas
Cape Broke
Cape Melville
Cape Bowles
Cape Disappointment
Cape Adair
Cape Bowman
Cape Tuxen
Cape Jacobs
Cape Kjellman
Cape Rosenberg
Cape Longing
Cape Alexander
Cape Agassiz
Cape Ducorps
Cape Kater
Cape Fairweather
Cape Tuxbury
Cape Sobral
Cape Errera
Cape Gerlache
Cape Gaudichaud
Cape Gauthier
Cape Anna
Cape Renard
Cape Monaco
Cape Roquemaurel

C. Dos Pontas
P. Desire
W.S.96
W.S.108
W.S.95
W.S.97
S. Francisco de Paulo
W.S.99
W.S.98
W.S.94
W.S.109
FALKLAND ISLANDS
W.S.78
W.S.77
W.S.79
W.S.80
Jason Is.
W.S.75
W.S.76
W.S.73
W.S.74
51
49
W.S.72
50
Queen Charlotte B.
W.S.81
48
W.S.71
52,56,57.
53,54,55,58.
W.S.92
W.S.93
W.S.85
W.S.90
I. Stephen
W.S.83
W.S.84
W.S.91
W.S.89
W.S.86
W.S.88
W.S.87
W.S.82
Burdwood Bank
La Maire Str.
FALKLAND ISLANDS
63°
62°
61°
Longitude West from Greenwich.


WEST COAST
OF
AFRICA
Track of R.R.S. "Discovery" in full line.
" " R.S.S. "William Scoresby" in pecked line
25° 20° 15° 10° 5° 0° 5° 10° 15°
10°
5°
0°
5°
10°
15°
30°
299
298
297
296
295
294
292
293
291
290
289
288
287
286
285
284
281
279, 280
282
283
278
277
276
275
274
273
272
271
270
269
268
W.S. 2
267
W.S.3.
266
1, 2
W.S.1
W.S.4
285
264
263
262
261
260
98
97
99
94
100
95
101
89
80, 91
W.S.136
92
259
82
83
84
85
86
87
88
253
252
254
255
256
257
258
251
W.S.5
W.S.6
W.S.135
W.S.7.
W.S.134
W.S.133
W.S.132
W.S.131
W.S.8

Drawn by Lieut. Cdr. J.M. Chaplin, R.N. 1928.

Malby & Sons, Lith.

CONTENTS

PART I. THE OBJECTS OF THE INVESTIGATIONS . . . . . *page* 143

PART II. THE SHIPS, THEIR EQUIPMENT AND THE METHODS USED IN RESEARCH

The Royal Research Ship 'Discovery' 151
Construction and original design 151
Purchase for whaling research and reconditioning 154
Present accommodation and machinery 155
Arrangements for scientific work 160

The Research Steamship 'William Scoresby'. 174
Construction, accommodation and machinery 174
Arrangements for scientific work 178

Apparatus and Methods 181
Plankton nets and apparatus 181
Trawls, dredges and other apparatus 204
Whale-marking 208
Hydrological instruments and methods 210
Survey equipment 215

Laboratory Methods 216

PART III. THE MARINE BIOLOGICAL STATION 223

INDEX 231

PLATES VII–XVIII . . . . . *following page* 232

DISCOVERY INVESTIGATIONS
OBJECTS, EQUIPMENT AND METHODS

PART I. THE OBJECTS OF THE INVESTIGATIONS

By Stanley Kemp, Sc.D.

THE proposal to send a scientific expedition to Antarctic waters was initiated by Mr E. R. Darnley, Chairman of the present Discovery Committee, rather more than ten years ago. The proposal had in view the systematic exploration of all the economic resources of the Dependencies of the Falkland Islands, but the main reasons for it are to be traced to the very rapid development of the whaling industry in those Dependencies, and to the fears which arose that this industry, like others formerly existing in both northern and southern hemispheres, would prove shortlived. For this reason the investigations undertaken bear mainly on the bionomics of the whales upon which the industry is based. The desirability of executing coastal surveys in the interests of the vessels which navigate these dangerous and largely uncharted waters was also realized.

Antarctic whaling by modern methods owes its origin to the Norwegian whaling pioneer, the late Captain C. A. Larsen, for it was due entirely to his enterprise and pertinacity in the face of much discouragement that operations were first begun at South Georgia in the season 1904–5. The venture was immediately successful: in the next season a whaling factory under Mr Alexander Lange, also a Norwegian, visited the South Shetland Islands, and by 1912 twenty-one whale-catching vessels were employed at South Georgia and thirty-two in the South Shetlands. Further development was restricted by Government action in the fear that the stock of whales would be unduly depleted, but during the war period a temporary increase was permitted.

From the first it was evident that a whaling field of the greatest importance had been discovered in the Dependencies of the Falkland Islands; before many years had passed it proved more productive than all those in the rest of the world combined and, until the present day, this leading position has been maintained.

The history of whaling in other waters, for nearly all the species which have formed the object of commercial enterprise, has followed one and the same lamentable course.[1] At first there is a period of great abundance, during which the industry develops rapidly and large profits are made. This, after a longer or shorter period, is followed by a decline which may be equally rapid, and culminates finally in the complete cessation of operations. Such has been the history of the Atlantic Right Whale or Nordkaper and of the Greenland Whale, species which have been hunted to the verge of extermination, while the northern rorqual fisheries, which have been conducted for little more than half a century, have declined to a mere vestige of their former greatness.

[1] For an authoritative history of whaling see Sir Sidney Harmer, *Proc. Linn. Soc. London*, session 140, pp. 52–95, 1928.

In a few instances the decline of a whale fishery has been due in part to causes other than depletion of the stock; but, bearing all the facts in mind, grave apprehension was felt regarding the future of the great whaling industry in the Dependencies of the Falkland Islands, and from the beginning the course of its development has been closely followed by Government. Regulations were put in force for the control of whaling, but it soon became evident that far more scientific knowledge was required for administrative purposes, and that the acquisition of such knowledge was the only way by which the permanent prosperity of the industry could ultimately be secured. It was accordingly suggested that a series of scientific investigations should be undertaken in southern waters and the question was referred by the Secretary of State for the Colonies to an Interdepartmental Committee. The Committee made a thorough examination of all the problems involved and in its report, published in 1920,[1] indicated the more important lines on which research was required. As a result of its recommendations the 'Discovery' was purchased, and in due course the present Discovery Committee was appointed by the Secretary of State to conduct the investigations. The cost of the work is defrayed from revenues raised from the whaling industry in the Dependencies of the Falkland Islands.

The main object of the work was thus to obtain further information on whales and on the factors which influence them, and before coming to a detailed description of the equipment and methods which are being employed, it will be useful to give some general account of the plan of operations which the Discovery Committee has adopted.

It was realized at the outset that a great deal of valuable information could be obtained by examination of whales brought in by whale-catchers. The precise identification of the common southern rorquals could not be regarded as definitely settled, for though it was generally recognized that the Blue and Fin Whales of the southern ocean closely resembled those to which the same names had been applied in the north, the possibility that the southern forms might represent a distinct race could not lightly be dismissed. Some might think this a question of purely zoological interest, but it must be pointed out that it has a very definite bearing on the economic aspect of whaling. If the rorquals in the south can be shown to be racially distinct from those which live in the north some degree of isolation of the two stocks may be inferred, and conversely, if no such distinction exists, some intermixture of these stocks is rendered probable. In dealing with migratory animals such as whales accurate knowledge on this point cannot fail to be valuable. It may set a limit to the area through which the southern stock ranges, and it will inevitably be of importance in studies of migration. This problem of the racial identity of southern whales is being attacked mainly by statistical methods.

In the economic study of any mammalian stock there are certain elementary facts which must be thoroughly understood before progress can be made. Among the more important are the rate of growth, the age at sexual maturity, the time of pairing, the period of gestation, the number at a birth, the length of the suckling period and the

[1] *Report of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands*, Cmd. 657, London, 1920.

nature of the food. In whales most of these facts are less easily ascertained than in other mammals and the information already available was very deficient. By special anatomical investigation it is, however, possible to obtain results which will throw much light on such questions, and the Committee consequently decided to build a laboratory at South Georgia. This laboratory, which is known as the Marine Biological Station, is erected on King Edward Point in Cumberland Bay, close to the whaling station at Grytviken. Work has been in progress since January 1925, and it is hoped that the first series of results will shortly be published. A description of the building will be found on p. 223.

During the southern winter whales are for the most part absent from South Georgia, and at Grytviken it is thus not possible to follow by anatomical investigation the full cycle of reproductive change throughout the year. The Committee considered it most important that complete observations of this kind should be made, and mainly on this account they arranged for the transference of the shore staff to South Africa during the winter of 1926. Thanks to the kindness of Messrs Irvin and Johnson they were accommodated at the whaling station in Saldanha Bay.

But work on shore, no matter how intensively it is undertaken, can only give solutions to some of the problems which are involved. It requires to be supplemented by observations at sea, and the principal reason for such research is the necessity for a thorough study of the environment of southern whales. Experience has shown that the hydrological and planktonic methods employed by the International Council for the Exploration of the Sea have been productive of valuable results in the north-east Atlantic and it could not be doubted that equally good results would follow their application in the south. Whaling, like most fisheries, fluctuates greatly from season to season, and the causes of these fluctuations are to be sought in changes in the environment. The food of southern rorquals is now known to consist exclusively, or almost exclusively, of large Euphausian crustaceans, which themselves feed mainly on diatoms. On analogy with conditions ascertained in the north, the seasonal abundance of the Euphausians on the whaling grounds of the Dependencies will be preceded by a period of great reproductive activity in the phytoplankton. The phytoplankton in its turn is dependent on the physical and chemical constitution of the water, and it is to hydrological, and ultimately perhaps to meteorological conditions, that the fluctuations in the whaling industry are to be ascribed.

So much could be inferred from the scientific work which had been done in the north, but much special investigation in the south was needed before theory and fact were brought into accord. The life history of the Euphausian which forms the main food of whales was unknown and no information existed on its relations with the other constituents of the plankton. Knowledge of the southern phytoplankton was limited almost entirely to the specific identification of the various species, and data on the water movements and general hydrology of the south were wholly deficient.

It was accordingly decided to equip a vessel for oceanographic research in southern waters. The 'Discovery', originally built for the National Antarctic Expedition,

1901–3, of which Captain (then Lieut.) R. F. Scott was leader, was purchased and refitted for her new work, and in July 1925, with the consent of His Majesty the King, she was commissioned as the Royal Research Ship 'Discovery'.

In drawing up a programme for the scientific operations of this vessel the Discovery Committee recognized the immensity of the area in which observations were required and the numerous directions along which research might profitably be undertaken. But practical considerations made it necessary to set some limit to the scope of the work, and in the plan which was finally adopted preference was given to investigations holding the most early promise of useful economic results.

To examine the conditions existing on the whaling grounds of the Dependencies was evidently of first importance and an intensive survey of the waters in the neighbourhood of South Georgia was planned. In this survey, which it was hoped to repeat annually, observations on the plankton and hydrology were to be taken at close intervals, the former comprising both vertical and horizontal tow-net hauls, worked on a scheme intended to give strictly comparable results, the latter designed to supply the fullest possible information on the temperature, salinity, hydrogen-ion concentration and phosphate and oxygen content of the water.

Such intensive surveys would not, however, yield all the information desired. Experience in the north had shown that conditions in any localized area can be properly understood only by a study of the mass movements of water in the surrounding oceans; alterations in the direction and intensity of these movements will involve marked alteration in the physical and biological environment of any small area situated in their path. It was thus necessary to supplement the survey of the South Georgia grounds by other investigations—necessarily less intensive—spread over a wider field. The region enclosed by lines connecting the Falkland Islands, South Georgia, the South Orkneys, the South Shetlands and Cape Horn was considered the most important, but observations were to be made whenever practicable in other parts of the southern ocean.

It is in these investigations that the 'Discovery' has been primarily engaged during a commission which lasted two years,[1] but before she left this country the Committee foresaw that the work was likely to be more than a single square-rigged vessel could undertake and that certain other lines of research were beyond her power.

Whales are well known to be migratory animals. In the southern winter they are for the most part absent from the waters of the Dependencies and there is definite evidence that the Humpback travels up the west coast of Africa in the southern autumn and returns to the south in the following spring. There is good reason to believe that this species pairs, and that the young are born, during this sojourn in warmer waters, and the available evidence indicates that little or no food is taken at this time. In the south there are abundant food supplies and the migrations have in consequence been called respectively the breeding migration (northwards, in the southern winter) and the feeding migration (southwards, in the southern spring). Such information as we possess

[1] Some indication of the degree of success which has so far attended the work may be obtained by inspection of the charts accompanying the Station List, Plates I–V of this volume.

about Blue and Fin Whales suggests that these species have habits similar to those of the Humpback.

In the economic study of whales it is of the utmost importance that we should have fuller and more accurate knowledge of these migrations. From what has been stated above it will be seen that north and south migrations of the three most valuable species may be inferred, but we have as yet next to no knowledge of the routes taken and not a particle of evidence regarding east and west movements.

To ascertain whether such east and west movements exist is most essential; for if the whales move freely round the Antarctic Continent it follows that the southern stock forms a single entity: excessive hunting in any one area will affect all areas adversely. If, on the other hand, such movement does not exist, the depletion of one area will not reduce the stocks in other parts.

In tracing the migrations of fish the method most generally adopted is that of marking. Fish are caught, suitable marks bearing a reference number are attached to them, and they are then liberated. A proportion of these marked fish are recaptured in the course of commercial operations, and the offer of a reward increases the chance that the mark, together with the necessary data, will be returned to the fishery authority. By this means valuable information on the migrations of fish has been obtained, and some years ago it was suggested that a similar method might usefully be employed with whales. It is, for obvious reasons, more difficult to mark whales than fish, but as a result of experiments made before the 'Discovery' sailed on her first commission, a practicable method was discovered. The method is explained on p. 208.

In considering the design of a second ship for investigations in the south, the Committee attached great importance to this question of whale-marking. A vessel of comparatively high speed was necessary, built generally on the lines of a whale-catcher, but it was recognized that she would also be required to assist in routine work on plankton and hydrology, and it was also considered desirable that she should carry a full-sized otter trawl for the exploration of certain areas in the Dependencies which might prove commercially profitable.

These varied requirements have been successfully met in the Research Steamship 'William Scoresby'. This vessel is named after the celebrated whaling captain, whose *Account of the Arctic Regions*, published in 1820, may be regarded as the first scientific contribution to the study of whaling. The 'William Scoresby' was launched at Beverley on December 31, 1925, and except for a brief return visit to England in 1927 has since been almost continuously at work in the south.

It will be seen, from what has been said above, that in the organization of research into whaling problems the Discovery Committee is proceeding on three separate lines of enquiry. The work at the Marine Biological Station is designed to supply essential information on the biology of whales themselves, while the vessels are engaged in a study of the environment of whales and in experiments from which a knowledge of their migrations may be derived.

Reference has already been made to the work on whales carried out at Saldanha Bay

in South Africa, and there have been other occasions when members of the scientific staff have been detached for special duty. Observations at whaling stations have thus been made at Durban in Natal and at Deception Island in the South Shetlands, while in the season 1927–8 a member of the staff accompanied the whaling factory 'Anglo-Norse' to the South Sandwich Islands—a region which had previously been little exploited by the whalers. The whales taken round these islands were examined, so far as was practicable, and some information obtained on the plankton and hydrology of the area. During the present season (1928–9) another member of the staff is on board the 'C. A. Larsen', a large whaling factory working in the Ross Sea.

Certain other work undertaken during the course of the investigations remains to be noticed.

Notwithstanding the number of expeditions which have undertaken oceanographic research in the south, the Antarctic still remains an unrivalled field for scientific effort. Since the primary aim of the investigations was an economic one, priority of place had evidently to be given to enquiries which might lead to immediately useful results; but it was recognized that occasions would arise when work in other directions could profitably be undertaken without detriment to the main objects of research, and it was the wish of the Committee that full use should be made of such opportunities.

The examination of the plankton conditions on the whaling grounds was already an important part of the programme of the 'Discovery', and in deciding what use might be made of occasions for work of a less obviously practical nature it was natural to consider an extension of these operations. The more strictly economic results were to be sought in the upper layers of the water, and work at greater depths, while it might also prove to have practical value, would without doubt result in a material increase in our knowledge of the biology of southern waters. When opportunity permitted, plankton nets, up to $4\frac{1}{2}$ metres in diameter of mouth, were accordingly used at all depths, and by this means a large amount of valuable material has been accumulated during the two years of the first commission.

An examination of the bottom fauna was evidently less relevant to the main purpose of the work, and it was decided that deep-sea trawling, which necessarily involves a great expenditure of time, could not be undertaken. The 'Discovery' was, however, supplied with a 40 ft. otter trawl and dredges, to be used in shallow water when circumstances allowed. The weather in the south is frequently unsuitable for off-shore work, and on a number of occasions the rich bottom fauna of the sheltered coastal waters of the Dependencies has been explored.

The 'William Scoresby', as has already been mentioned, was designed to carry a full-sized commercial otter trawl and the main purpose of this equipment was an examination of the supplies of fish on the submarine plateau situated between the Falkland Islands and the South American coast. There are grounds for the belief that fish exist in marketable quantities in this area, and a survey was planned in the hope that it might result in the establishment of a trawling industry in the locality. The 'William

Scoresby' has hitherto undertaken this work during the southern winter when the whaling stations in the Dependencies are closed.

At South Georgia Elephant Seals are abundant, and each year, when they haul up on the beaches during the breeding season, great numbers are killed for the oil contained in their blubber. The industry is a profitable one and has been carried on for many years under strict Government control. The regulations are well devised and there is happily little fear that the stock is being depleted; but since there are many points in the natural history of these animals on which little is known, the Committee considered that some attention should be paid to them in the course of the Discovery investigations. It was also thought that the bird life of the island should not be neglected. These two branches of work have been in the hands of one of the staff of the Marine Biological Station.

Prior to the commencement of the Discovery investigations little hydrographic surveying had been done in the Dependencies of the Falkland Islands, and the Discovery Committee hoped that in the course of their work it would be possible to make considerable improvements to existing charts. Of the known harbours few had been surveyed, the positions of many of the islands were doubtful and the whaling community was most anxious for better information. To carry out surveys in conjunction with the programme outlined above was admittedly not easy to arrange, but the Admiralty, through their representative on the Committee, strongly supported the proposal and a trained surveyor was seconded from their Hydrographic Department as one of the executive officers of the 'Discovery'. In spite of limited opportunities this officer was able during the past commission to carry out some important surveys in the Dependencies, and an account of the work done will be published in due course in these Reports. During the season 1928–9 assistants and a specially built motor launch have been placed at the disposal of this officer, who will be occupied entirely in hydrographic survey.

In all the investigations which have been made in the south, the co-operation of the whaling community has been a very material advantage, and we owe a debt of gratitude in particular to the managers of the land stations. Facilities for work on the flensing plane and opportunities for cruises on whale-catchers were freely given; labour, which often could ill be spared, was furnished for the preparation of whale skeletons or for work at the biological station; transport for personnel and material was placed when needed at our disposal, and arrangements made for periodic supplies of fresh provisions. To these benefits the managers added their own most generous hospitality. Our thanks are specially due to Capt. V. Esbensen at Grytviken, to Capt. T. Sörrle at Stromness, to Mr L. H. Hansen at Leith and to Capt. Øre at Deception Island.

The reconditioning of the R.R.S. 'Discovery' and the construction of the R.S.S. 'William Scoresby' were carried out by the Crown Agents for the Colonies with the advice of Messrs Flannery, Baggallay and Johnson, Ltd., Consulting Naval Architects. The Crown Agents have been responsible for all contracts for provisions and other supplies for the two vessels, as well as for the erection and equipment of the Marine

Biological Station. Their efficient assistance in all these matters has added largely to the success of the work.

In concluding this brief outline of the objects of the Discovery investigations it may be pointed out that the work is still in progress and that henceforward the presentation of results and the accumulation of fresh data will proceed simultaneously. Thanks to the courtesy of the Trustees of the British Museum accommodation for those of the scientific staff who are working up results in this country has been found at the Natural History Museum, South Kensington, where by reason of the reference collections and library, every possible facility is afforded. The members of the scientific staff are taking up the economic aspects of the material and data which have been collected, but the Committee has been fortunate in receiving promises of help from specialists in a number of subjects, and it is hoped that their contributions, which will mainly be of scientific interest, will also find a place in these Reports.

THE DISCOVERY INVESTIGATIONS, OBJECTS, EQUIPMENT AND METHODS

PART II. THE SHIPS, THEIR EQUIPMENT AND THE METHODS USED IN RESEARCH

By Stanley Kemp, Sc.D., and A. C. Hardy, M.A.

(Plates VII–XVII, text-figures 1–33)

In the Reports of most expeditions which have engaged in marine biological research such matters as scientific equipment and methods, if discussed at all, are dealt with very briefly. Yet there are reasons why these subjects should be treated in some detail: first because a description of methods, of nets and apparatus and of the way in which they were handled, will often be useful in the interpretation of results, and, secondly, because the experience gained by one expedition is likely to prove of service to another. In modern oceanographical work a technique of some elaboration is required, and if work is to run smoothly and without waste of time every detail of procedure must be thought out in advance. Mistakes are easily made and may be costly, and difficulties of many kinds must be overcome, especially if investigations in deep water are to be undertaken.

In this paper the equipment of the 'Discovery' and 'William Scoresby' is described at some length, with notes on the arrangement and fittings of the ships' laboratories and an account of the methods employed in hydrology and in the collection and preservation of zoological material. In various directions, but more particularly with biological gear, we have tried to make some improvement on established methods, and these attempts—not all of them successful—are discussed in their proper place. A large part of the biological work was concerned with plankton, and plankton methods and apparatus are in consequence treated in greater detail.

It is necessary in the first place to give some description of the vessels employed in the investigations, and for the following account of their arrangement and accommodation, together with the plans on Plates VIII and IX, we are indebted to Mr A. Harker of Messrs Flannery, Baggallay and Johnson, Ltd., Consulting Naval Architects to the Crown Agents for the Colonies.

THE ROYAL RESEARCH SHIP 'DISCOVERY'

CONSTRUCTION AND ORIGINAL DESIGN

The 'Discovery' was constructed by the Dundee Shipbuilding Company for the National Antarctic expedition of 1901–3, and was intended essentially for Antarctic exploration and polar research. The vessel was designed by Sir W. E. Smith, late Chief Constructor at the Admiralty, and was built under his direction and with the assist-

ance of Admiralty officials. She is rigged as a barque with fore, main and mizen masts, and her principal dimensions are as follows:

	ft.	in.
Length overall	198	0
Length on water line from fore edge of stem to axis of rudder ...	172	0
Extreme breadth	34	0
Depth amidships from top of ceiling to top of upper deck beam	18	6
Designed draught	16	0
Designed displacement at 16 ft. 0 in. water line, about 1600 tons		

Construction. The ship was constructed of wood throughout with the exception of the fastenings, which were mostly of galvanized iron, except within a radius of 30 ft. of the magnetic centre or magnetic observatory, where they were of naval brass. The framing of the vessel generally was of English oak, grown to form wherever practicable; the beams on the main deck were, however, of pitch pine. The main planking was of Canadian elm below water and pitch pine above water, varying in thickness from 7 in. at the keel to about 4 in. at the sheer. An outside sheathing or doubling of green-heart about $3\frac{1}{2}$ in. thick was fitted fore and aft, extending about 11 ft. below the water line except at the forward end of the vessel where it was extended down to the keel at the forefoot as a special protection against ice. The inner bottom planking was of Riga fir about $3\frac{1}{2}$ in. thick, excepting below the clamps in the 'tween decks where it was about 4 in. thick. The beam shelves and clamps were exceptionally heavy, also the main waterways and inner waterways, resulting in the vessel having an average general thickness of 2 ft. throughout her girth.

The forefoot was of the most solid construction, with special ice protection extending to about 5 ft. above the load water line. This protection consisted generally of oak timbering built up behind the stem to a depth varying from 8 ft. at the head to about 10 ft. at the foot, and, on top of the wood, galvanized steel plates were also fitted to reduce chafe as far as possible. Beams and heavy diagonal timbers, all of oak, were introduced in the lower part of the vessel at the forward end to withstand ice pressure.

The decks of the ship were of Dantzig fir, varying from $3\frac{1}{2}$ in. in thickness on the weather deck to $2\frac{1}{2}$ in. on the lower-deck flats. The bulkheads—which were five in number—were of wood throughout, with the exception of that at the forward end of the boiler space, which was of steel to guard against deterioration due to heat from the boilers.

In the **Original Design of the Vessel** a topgallant forecastle was arranged forward, and the entrance to crew space and galley in a house abaft the fore-mast. Between the fore and main masts a magnetic observatory was built, with houses abreast of it on either side, occupied mainly by laboratories, and with the bridge above. The entrance to the wardroom was immediately abaft the magnetic observatory, and a large skylight for light and air to the wardroom was placed amidships.

The engine and boiler casings were of steel, situated between the main and mizen

masts and extended at the forward end to form a winch house. This house accommodated a steam winch, having cylinders 8 in. in diameter and 12 in. in stroke. Hand steering gear only was fitted. It was of the ordinary barrel type, with purchase to the tiller at rudder head, and was placed at the after end of the vessel.

Separate hatches on the after deck provided access to a store room on the starboard side and to a sail and canvas room on the port side. Two houses were built, one on each side of the ship abreast of the screw aperture, for use as paint lockers, stores, armoury, etc.

Eight boats were provided in davits, the complement consisting of five 26-ft. whalers, one 20-ft. cutter, and two Norwegian prams.

The steam windlass was fitted on the upper deck, below the topgallant forecastle, with a vertical spindle extending to a capstan head above. On its starboard side a donkey boiler was placed, and a small coal bunker. The anchors and cables were specially heavy, and of the ordinary Admiralty pattern.

Below the upper deck, the 'tween decks at the forward end was occupied by store rooms and chain lockers. Between two bulkheads immediately abaft the chain locker was the galley, arranged on the centre line of the vessel, with compartments on either side used as a laboratory, a sick bay and store rooms. The crew and petty officers were berthed immediately abaft the galley space.

Between the forward end of the machinery space and the after end of the crew space was the wardroom, arranged centrally, with ten cabins on either side and across the after end, and a large pantry on the starboard side. The engine and boiler space, engineers' stores and workshop, wing coal bunkers, sail and canvas room and store rooms were at the after end of the vessel.

In the lower holds of the ship, below the accommodation spaces, the space was subdivided into stores and provision chambers with room for fresh-water tanks in the forward part. These tanks had a capacity of 25 tons and were made of zinc plates cased outside with wood. Amidships were coal bunkers, with ballast tanks below, the latter so designed that they could be used for carrying coal when required.

The propeller and rudder were both specially constructed, so that either could be removed and lifted on to the deck through trunk ways built between the skin of the vessel and the deck. This provision was made so that either the propeller or rudder could be dealt with at sea in the event of damage.

The propelling machinery originally installed is still in use and a description of it will be found on p. 159, which deals with the vessel as at present arranged. A full and interesting account of the design and construction of the ship as originally built will be found in a paper read by Sir W. E. Smith on April 12, 1905, before the 46th Session of the Institution of Naval Architects.[1]

Service with the Hudson's Bay Company. On completion of her service in Antarctic exploration the 'Discovery' was acquired by the Hudson's Bay Company, who con-

[1] Smith, *Trans. Inst. Naval Architects*, XLVII, pt. 1, 1905.

verted her for commercial trading purposes, her great strength rendering her very suitable for work in the Arctic fur trade. For her special service with this Company the windlass was removed from below the forecastle deck and fitted on the forecastle head, the space below the forecastle deck being used as accommodation for the crew. The magnetic observatory and the dredging laboratories on the sides of the vessel were extended to accommodate the ship's officers. The whole of the accommodation in the 'tween decks was removed, and the vessel was left with clear hold space from the collision bulkhead to the boiler-room bulkhead, so as to give as large a carrying capacity as practicable. The arrangements for unshipping the propeller at sea were dispensed with, and a permanent propeller shaft of the ordinary type was fitted. A number of fittings, including the engineers' workshop, were also removed, since they were considered unnecessary for ordinary trading purposes.

PURCHASE FOR WHALING RESEARCH AND RECONDITIONING

When the question of undertaking scientific research in Antarctic waters was considered by the Interdepartmental Committee for Research and Development in the Dependencies of the Falkland Islands, a special subcommittee under the chairmanship of Captain C. V. Smith, R.N., was appointed to advise on the type of vessel and equipment which would be necessary. The report of the subcommittee was published in 1920 with that of the Committee itself (Cmd. 657, p. 145), and recommended the provision of two wooden vessels with auxiliary steam power.

A second interdepartmental Committee was then appointed to consider the acquisition of two research vessels such as had been proposed. This Ship Committee included the Director and Assistant Director of Naval Construction, representatives of the Department of the Engineer-in-Chief of the Admiralty, the Consulting Naval Architects to the Crown Agents for the Colonies, the Royal Geographical Society and other Departments concerned in marine biological research. It was found impracticable owing to financial considerations to build the two ships required. The structural details and qualities of vessels which had already been used in polar research, and such whaling and sealing vessels as were on the market, were therefore examined, and after a number had been considered it was decided that the 'Discovery' most nearly met all requirements. In making this decision the Ship Committee was influenced largely by the great strength of the vessel and by the fact that she had been primarily constructed for work in the Antarctic. Navigating in ice-laden waters she would be safer than any other vessel afloat, and though it was realized that to winter in the south did not come within the scope of the work contemplated, the risk that she might on some occasion be hemmed in by ice could not be overlooked.

In consequence of this decision, and before purchase was completed, as detailed an examination as possible was made of the ship and her machinery; with the consent of her owners she was dry-docked for this purpose in January, 1923.

Reconditioning. A preliminary inspection had already shown that the vessel had "hogged" to the extent of $3\frac{3}{4}$ in. in 130 ft., indicating that she had been badly strained, and it was also found that owing to the lack of air courses to the inner timbers considerable deterioration had taken place. The extent of this deterioration could not be fully determined since it involved practically the entire stripping of the vessel. It was, however, evident that renovation and repair on a considerable scale would be required and that new masts, spars, sails and rigging were necessary. The machinery generally was in excellent repair, the main engines requiring little work to restore them to good condition. The main boilers bore signs of deterioration, owing to corrosion, and the lagging throughout required renewal.

These defects in condition were fully appreciated by the Ship Committee; but after careful consideration of the alternative of building a new vessel, and with the knowledge that no other second-hand ship of such robust construction as the 'Discovery' was obtainable, a recommendation was made that she should be purchased.

After purchase, which was effected in 1923, timbers which could not be examined earlier were found on disclosure also to be deteriorated, necessitating further renewals. The main framing of the ship was more or less affected throughout, particularly that portion which was above water. The stern was very badly deteriorated, the planking mostly in bad condition, and the main keel was found to have been damaged and to require renewal in part. A number of beams on both main and upper deck were found to be defective and the deck planking generally required renovation. Detailed specifications were prepared for the complete reconditioning of the ship, providing for renewal of all defective parts and including special accommodation and laboratories suitable for the intended service. Competitive tenders were invited, and the work was finally placed in the hands of Messrs Vosper and Co., Ltd., of Portsmouth.

During the reconditioning of the vessel and the complete renewal of masts, spars, sails and rigging, advantage was taken of previous experience to make certain alterations which were expected to improve her sailing qualities. For this reason the centre of effort was moved forward, by placing the fore and main masts farther forward than in the original arrangement, and a slight increase was also made in sail area. To facilitate the handling of sails it was decided to fit upper and lower topgallant sails (Plate VII) instead of the single topgallant sail of the original rig.

PRESENT ACCOMMODATION AND MACHINERY

The general arrangement of accommodation on the vessel after reconditioning is described below and illustrated in the profile and plans shown on Plates VIII and IX. The arrangements for scientific work are described separately on p. 160.

On the **Forecastle Head** the deck planking was completely renewed. A capstan head is placed in the centre of the deck, and at its after end two skylights are fitted for light and air to the galley The usual bollards and fair-leads are provided, together with special deck lights, giving light and air to the space below. A powerful searchlight

is arranged near the after end of the deck, just forward of the skylights to the galley. Leadsman's sounding platforms are fitted on either side.

The **Bridge** is arranged on the top of the midship house and is of teak throughout, with rails, stanchions and weather boarding. The deck is kept very slightly wider than the width of the midship deck house, excepting for about 4 ft. fore and aft at the forward end, where it is extended on each side to about the maximum beam of the ship at the rail, to give good facility for conning the ship by the officer on watch. The standard compass is placed near the forward end of this bridge and telegraphs stand on each side for communication with the engine room. A steam and hand steering gear is fitted at the after end of the bridge, with a steering compass for the helmsman. The emergency batteries for the wireless installation are arranged in a special box immediately above the wireless house and on the port side. A laryngaphone telephone is fitted on the starboard side of the bridge for direct communication with the engine room.

The boats conform to Board of Trade requirements and consist of two 24 ft. whalers, two 18 ft. lifeboats, a dinghy and a pram. The whalers are carried on either side of the bridge, the dinghy and pram on top of the winch house, and the lifeboats on skids farther aft.

Upper Deck. Below the forecastle head a specially made steam and hand windlass is fitted for dealing with the vessel's cables: it is provided with a vertical spindle extending to the capstan head. The sheltered space abaft the windlass is used as a carpenter's shop, and on either side there is stowage for oilskins, and rooms and lockers for the storage of scientific and other gear. In the original arrangement an auxiliary steam boiler with a small coal bunker was fitted under the forecastle head; but this was removed, as it was not likely to be required and the room it was occupying could more usefully be devoted to other purposes.

Immediately abaft the forecastle and in the middle of the fore deck a wood house is built, about 8 ft. square. This house is divided into two compartments, the forward compartment being the entrance to the galley and the aft compartment the entrance to the crew's quarters. These two entrances being on opposite sides of the ship give the advantage of a lee door, since the galley and crew spaces are in communication below deck. Two large skylights are fitted, one forward and the other abaft the entrance to the deck house, supplying light and air to the galley and crew spaces. The upper parts of both skylights are portable to facilitate handling stores.

A large teak deck house, 27 ft. fore and aft and about 16 ft. wide, is constructed just forward of midships, between the fore and main masts. At the forward end of this deck house is a large chart room and at the after end a deck laboratory, both extending the full width of the house. Between the chart house and the deck laboratory are, on the starboard side, a spare cabin, with the lobby and entrance to the wardroom abaft it, and on the port side, a large deck locker for survey instruments, and the wireless cabin between it and the laboratory.

The chart house, apart from the usual furnishings, contains several special features: a chronometer box for three chronometers with electric lights for keeping the box at a constant temperature, a distance thermograph for giving continuous readings of the temperature of the water at a few feet below the surface, and an echo-sounding apparatus for dealing with soundings up to about 130 fathoms.[1] In addition to the above an experimental deep-sea echo-sounding apparatus was originally installed, but proved ineffective owing to loud water noises. After the sister keels had been fitted in 1926 these noises increased to such an extent as to render the apparatus unserviceable.

The wireless cabin contains two separate Marconi wireless sets, each of $1\frac{1}{2}$ kw. capacity; one set being the well-known quench-gap type and the other the continuous wave type. With this apparatus communication was on one occasion successfully maintained up to as much as 2680 miles.

The deck laboratory is fully described on p. 169.

The two deck houses referred to above—the entrance to the crew's quarters and galley and the midship deck house—are both of exceptional strength, the coamings being of heavy section teak, and the sides constructed of two thicknesses of teak, clinched together and with insulation between, making a very strong combination to withstand the severest weather conditions.

A large teak skylight is placed between the main-mast and the after end of the midship deck house, to supply light and air to the wardroom and the cabins which communicate with it.

At the forward end of the boiler casing a large steel house 10 ft. long and 16 ft. broad is erected to enclose the steam winch. The engine and boiler casings extend from the fore side of the mizen-mast to the after side of the winch house. On either side of the engine room casings is a series of ice tanks, fitted with steam pipes and with connections to the freshwater tanks. The tanks can thus be used for watering ship from ice when ordinary supplies are not available. Both casings and tanks are of steel, as originally fitted to the vessel. A single hatch is fitted abaft the engine casing on the after deck, for access to the sail and canvas store. A hand steering gear is fitted near the fore side of the propeller trunk hatch for use when under sail alone.

Two teak houses, constructed similarly to the houses on the fore deck, are arranged at the after end of the vessel abreast of the propeller trunk and inset from the rail. In these houses are included the lamp locker on the starboard side and an ammunition store on the port side, each provided with a small hatch giving sheltered access to the after peak. Large gratings are fitted at about half the height of the bulwarks at the extreme after end of the ship, covering the steering gear leads and tiller and affording a platform for handling nets.

The lighting of the compartments below deck is effected by means of deck lights. Port lights in the side of the ship would have been a danger in ice navigation and, in a wooden vessel, are difficult to arrange without materially reducing the strength of the

[1] For an explanation of this method of sounding see *Nature*, March 29, 1924, p. 463.

top sides. These lights are arranged so that either mushroom ventilators or ordinary flat deck lights can be fitted. In addition the screw tops of the mushroom ventilators can be removed and cowl ventilators or deadlights substituted when required.

Coaling scuttles, of cast iron and about 18 in. in diameter, are provided. Four of these scuttles are arranged immediately above the wardroom, and special portable trunks are provided for communication with the bunker space below the wardroom accommodation when coaling ship.

The space on the **Main Deck** forward of the boiler room is mainly devoted to living quarters. At the forward end of the ship immediately abaft the stem are stores for provisions and canteen supplies. Abaft this space the galley is situated on the centre line of the vessel; it is provided with a large cooking stove, and the galley store is placed on the port side abreast of the stove. On either side of the galley are separate compartments, that on the port side being the sick bay, while that on the starboard side consists of an insulating chamber with a CO_2 refrigerating machine, and abaft it a cabin for two petty officers. Abaft the galley space, as described above, the crew and petty officers are quartered, the petty officers' cabins (four in number) being constructed on the port side, and the crew occupying the remainder of this portion of the ship.

The wardroom accommodation extends from the forward end of the boiler room to the after end of the petty officers' and crew space, and contains ten cabins all communicating with a large wardroom about 24 ft. long by 12 ft. wide. The cabins and wardroom are comfortably furnished in polished mahogany. A pantry is provided for wardroom use and leading from the wardroom-lobby is a small officers' bathroom. On the port side at the forward end of the wardroom accommodation is a laboratory, with a small darkroom attached. The furniture of the wardroom consists of a large central table with swivel chairs, a bookshelf, slow combustion stove and small upright piano. An electric fan is fitted at the after end to assist ventilation.

Flush hatches are arranged in the main deck in convenient positions, as indicated in Plate IX, for communication with store rooms, provision lockers, freshwater compartments and bunkers below the main deck. Abaft the machinery space a large compartment is provided for the stowage of sails, canvas, blocks and other rigging stores.

Below the Main Deck, at the forward end and immediately abaft the stem, store rooms are arranged, with a chain locker in two compartments on the centre line. The remainder of the space between the chain locker compartment and coal bunker is a hold, divided into five compartments, the aftermost of which contains the freshwater tanks only. These tanks are six in number, each having a capacity of 5 tons, giving a total of 30 tons of fresh water for drinking purposes: they are all interconnected and any one tank can be used independently of the others. The freshwater tank compartment also contains bilge valve boxes, with pipes leading to each of the principal compartments forward of the freshwater tank space, and with valves operated from the

main deck immediately above. A main suction line is led direct from the engine room to the bilge valve boxes.

The remainder of the compartments between the freshwater tank space and chain lockers are arranged for the stowage of provisions and scientific and other gear. Between the after end of the freshwater tank compartment and the fore end of the boiler space is a coal bunker, the total capacity of this and of the wing bunkers being 208 tons.

The whole of the spaces below the main deck are subdivided by means of wooden bulkheads, constructed of two thicknesses of tongued and grooved pine, one horizontal and one diagonal, with painted felt between. The two thicknesses are clinched with strong fastenings, providing a watertight construction. In addition to the thwartship bulkheads a similar fore and aft bulkhead extends from the after end of the bunker space to the after end of the chain locker, completely dividing the vessel on the centre line. The forward bulkhead of the boiler room is of steel as in the original arrangement, and in addition a light steel screen is fitted between the engine and boiler rooms.

Full advantage is taken of the space available in the 'tween decks alongside of and above the boilers for bunker space, the bunkers in this part of the ship being constructed of steel.

The **Propelling Machinery** is the same as in the original vessel and it has not been altered in any material way. Steam is supplied by two cylindrical boilers, each 10 ft. 3 in. in diameter and 9 ft. long, each having two furnaces: the combined total grate surface provided is 67 sq. ft. The maximum working pressure is 150 lb. per square inch.

The engines are of the triple expansion type designed to develop 450 H.P. when working at about 90 revolutions per minute. The diameters of the cylinders are: high pressure 14½ in., intermediate pressure 22½ in., low pressure 36 in.: length of stroke 30 in. The high and intermediate pressure slide valves are of the piston type, the low pressure being a flat valve, all actuated by the usual link motion. The condenser cooling surface is 560 sq. ft. The main air, feed and bilge pumps are worked by levers from the high pressure engine. The shafting is of steel, the crank webs being forged in one with the shaft. The propeller is two-bladed, 10½ ft. in diameter and with a pitch of 12 ft. The boss is of gun-metal, and the blades are of high tension bronze.

The auxiliary machinery fitted in connection with the main engines comprises a reversing engine, two centrifugal circulating pumps and an auxiliary feed pump. The circulating pumps are each capable of pumping 100 tons of water per hour; they have connections to the bilge and each is arranged with an auxiliary air pump. The outlet of the main condenser circulating water is kept well above the water line, and all pipes are arranged so that they can readily be drained and, as far as practicable, kept above the floor plates. Owing to the special service on which the vessel was to be employed all cylinders, including those of the auxiliary machinery, are made self-draining and each main engine cylinder is water-jacketed.

On reconditioning the ship certain new auxiliary machinery was installed: a 10 ton evaporator with freshwater distiller working in conjunction with it: an electric generating

installation, consisting of a compound steam engine directly coupled to an electric generator, having an output of about 15 kw. at full power: an emergency generating set, fitted on the 'tween decks flat on the port side at the after end of the engine room, consisting of a 15 kw. generator driven by a direct coupled Parsons 21 B.H.P. petrol/paraffin motor having three cylinders. Either of these generating sets is capable of lighting the whole vessel, as well as supplying power for the searchlight and wireless installations.

The workshop, which had been removed whilst the vessel was in the service of the Hudson's Bay Company, was again provided during the reconditioning of the ship. The shop includes a small 6 in. Drummond lathe of up-to-date pattern with screw cutting and slide surfacing gear, arranged to be driven by electric motor and foot-treadle, a full equipment of tools and a small hand-drilling machine.

The arrangement whereby the rudder and propeller could be lifted on deck was dispensed with when the vessel entered the service of the Hudson's Bay Company. It was, however, restored during the reconditioning of the ship and is of the same design as shown in plate vii of the paper by Sir W. E. Smith referred to on p. 153.

In 1926, when the vessel was dry-docked at Simon's Town, sister keels were fitted to reduce the heavy rolling, which had been found a serious disadvantage in scientific work. In order to obviate any danger which might arise through contact with ice, these keels are attached in short lengths by bolts which will draw under any exceptional strain.

ARRANGEMENTS FOR SCIENTIFIC WORK

Some difficulty was experienced in making suitable arrangements for scientific investigations in the 'Discovery'. A square-rigged vessel was found to be ill-adapted for oceanographical work: standing rigging and running gear offer serious obstructions to the handling of large nets, and the plan which was finally adopted is not by any means ideal. With her high bulwarks ($4\frac{1}{2}$ ft. above deck level) and the pronounced "tumble home" of her sides it was impossible to work vertical nets and water bottles in the usual way. It was necessary to place the operator outboard, on a platform slung at deck level, a position not without its discomforts when the ship was riding to a heavy swell. A general idea of the deck arrangements can be obtained from Plate IX.

Main Winch. When the 'Discovery' was altered and refitted for her new work it was not found possible to change the position of the winch, which is placed, as it was in Captain Scott's time, abaft the main-mast and on the forward side of the engine-room casing. This position is not a good one, for the wires lead forward and must make two right-angle turns round fair-leads before they can be brought aft. The ideal position would be abaft the engine room, with ample clear space between the winch and the stern rail; but lack of room precluded this arrangement in the 'Discovery'.

The winch (Plate X, fig. 1) was made by Messrs Clarke, Chapman and Co., Ltd. It is of the horizontal steam trawler type, with 8 × 12 in. cylinders and with both single and double purchase steel gearing, fitted with machine-cut helical teeth. It carries

two steel drums, with cast steel ribbed end flanges, and in each of these the barrel is 12 in. and the end flanges 48 in. in diameter. The drum on the port side is $12\frac{1}{2}$ in. in length, designed to take 1000 fathoms of steel wire rope $1\frac{5}{8}$ in. in circumference. That on the starboard side is 5 ft. in length and carries 5000 fathoms of tapered wire rope, $1\frac{3}{4}$ to $1\frac{1}{2}$ in. in circumference. The rope is guided on to the larger drum by a traversing gear driven either mechanically or by hand, and a similar form of hand-operated gear is fitted to the smaller drum. The engine is capable of developing 50 H.P. with a steam pressure of 150 lb., giving a pull of $3\frac{1}{2}$ tons on the rope from the top of the coil. The winch, which weighs $9\frac{1}{2}$ tons exclusive of wires, was designed to give a speed of haul on the top coil of 100 ft. per minute; the average rate is, however, in excess of this figure and with large plankton nets and dredges a speed of over 200 ft. per minute can be attained when required. As a protection against weather the winch is fitted inside a steel deck house, and warping drums, fitted to each end of the shaft, extend outside the house.

Though some defects are to be noted the winch on the whole proved very satisfactory, working smoothly and easily under all conditions.

In order to resist the enormous lateral thrust caused by winding in long lengths of wire rope under high tension, the end flanges of the drums, as noted above, were specially strengthened. The larger drum, however, is built in three pieces, riveted together, and on one occasion after deep-water operations it was found that the inner end flange no longer ran true. Later, in Simon's Town dockyard, the wire was rove off, and it was found that the rivets holding the end flange to the centre barrel had partially sheared. Repairs involved the dismantling of the winch house and occupied a considerable time. Experience indicates that large winch drums should, whenever possible, be cast in one piece.

Some difficulty was experienced in fitting the automatic traversing gear to the larger drum owing to the taper of the wire rope. The pitch of the screw on the rod which carries the traveller was made to suit the middle diameter of the wire, but in practice this did not work well. When more than half the wire is outboard the traveller, on hauling, moves too slowly, and the wire takes riding turns. To obviate this a clutch and alternative hand gear was subsequently fitted, but it would probably be better if the screw pitch were adjusted to the maximum diameter of the wire. The rollers of the traveller should be fitted with ball or roller bearings and should be sufficiently staggered to allow free passage to the swivel and shackles which form the connection between the wire and the bridles of the trawl.

The positions of the **Pedestal Fair-leads** are shown in Plate IX, and two of them are to be seen in Plate X, fig. 2: all are securely bolted to tie plates lying below the deck and stand with their centres 19 in. above deck level. In the single fair-leads the height of the revolving part is 9 in. and the minimum diameter 9 in.: in the double fair-lead these measurements are $6\frac{1}{2}$ and 12 in. respectively. The revolving parts were in the first place made of cast iron, but in the course of a year, during which compara-

tively little deep-water work was undertaken, it was found that the wire had cut deeply into them and spares made of manganese steel were substituted.

It will be seen that the arrangement of fair-leads allows the longer wire to be used on either side of the ship and it was hoped that two flights of nets, one deep and one shallow, could be towed at the same time.[1] In the 'Discovery' this was found impracticable in routine work, and though the young-fish trawl was often used with one wire, while a flight of shallow horizontal nets was towed with the other, it was not possible to work two sets of large nets simultaneously. It was found, moreover, that to shoot deep-water nets on the starboard side was likely to cause serious damage to the wire. After several long hauls had been made on this side of the ship it was discovered that the wire was rapidly becoming unlaid and it would no doubt have been ruined if this practice had been continued. This action, which was quite unexpected, is due no doubt to the two turns round the fair-leads, these turns being right-handed when facing the bow of the vessel. Hauling under a heavy strain on the starboard side tends to take out the lay; to work properly a wire laid up left-handed would be required, and this of course would prove equally inefficient on the port side. With the winch in a better position and straighter leads, trouble of this nature is not likely to occur.

The port and starboard stern **Fair-leads** are mounted in the rail, which is cut away for the purpose. They consist of four rollers, mounted in a heavy frame, with a snatch above: the vertical rollers are hourglass-shaped and all are brass bushed. The outboard horizontal roller was originally $3\frac{1}{2}$ in. in diameter, but was found to give too sharp a nip, flattening the wire unduly under heavy strains. A 5 in. roller was substituted and the diameter might be increased even further with advantage. The fair-leads gave a certain amount of trouble, for with heavy work it was found that the frames became strained and continual attention was needed to see that the rollers revolved freely. It is important that the frame should be of very solid construction and that all the rollers should be fitted with ball or roller bearings. The snatch at the top should be so made that, when it is open, the whole space between the vertical rollers is clear; if it overlaps the rollers, shackles and the screw stops used in plankton work are liable to jam when being hauled through the fair-lead.

Heavy Accumulators. The large compression springs shown in Plate IX (47) are for use as accumulators. By means of the nipper referred to on p. 207 the strain on the warp can be taken on this spring, which will thus compensate for sudden jars caused by the pitching of the ship and save the gear from damage. Full compression is reached with a strain of 6 tons. It was found in practice that the springs were too strong; they would need to be weaker and much longer in order to give sufficient play. Experience tends to show that heavy accumulators for deep-water work are not necessary. For plankton work at shallow depths a light accumulator giving plenty of play is an undoubted advantage, but with deep nets sufficient compensation is afforded by the spring of the wire rope and by the fact that under varying strains its curvature will alter.

[1] See Hjort, in Murray and Hjort, *Depths of the Ocean*, p. 49, fig. 32, London, 1912.

Auxiliary Winch-drum. Close to the winch on the starboard side is a drum fitted with clutch, brake and hand-operated traversing gear, designed to accommodate 3000 fathoms of wire 6 mm. in diameter (Plate X, fig. 2). It is driven by a sprocket wheel on the main shaft of the winch by means of a roller chain, the brake handle being extended to the control position in the winch house. When not in use the chain was disconnected. This auxiliary winch was intended for handling grabs and light bottom apparatus, but was used mainly for the storage of lengths of wire used with fish traps.

Light Deck Machines. For hydrological work and vertical plankton nets three small engines and drums are provided in addition to the sounding machine. All are placed on the port side and are used with wire 4 mm. in diameter. One engine, coupled to a drum holding 3500 fathoms of wire, is placed near the winch house (Plate XI, figs. 1, 2) and is used for vertical nets. The second, just forward of the bridge (Plate XII, figs. 1, 2), has two drums, one on either side, each with 500 fathoms of wire, and is used mainly for insulating water bottles worked at shallow depths. The third engine (Plate XIII, fig. 1), with 3500 fathoms of wire, is placed on the forecastle head and with it deep-water temperatures and salinities are taken with reversing water bottles. All three machines are fitted with the same type of engine, made by E. Reader and Sons —a twin cylinder two-crank engine, class D.F., with cylinders $3\frac{1}{2}$ in. in diameter by 3 in. stroke, designed to develop 9 brake horse-power at 500 revolutions per minute with 155 lb. steam pressure at the stop valve. Originally these engines were directly coupled to pinion shafts, driving spur wheels bolted to the rims of the drums, the ratio of gearing being 1·87 to 1 in the machine carrying 500 fathom drums and 3·47 to 1 in those with 3500 fathom drums. The machine with the shorter length of wire was quite satisfactory with this ratio, but the two deep-water machines, though they doubtless possessed sufficient power, proved unable to start with a standing weight of $2\frac{3}{4}$ cwt.[1] Even when the engine did start, with a lesser weight, it hauled very slowly and was liable to stop every time the vessel rolled to starboard. To overcome this difficulty further gearing was introduced by means of a lay shaft driven by sprocket wheels and a roller chain, the new gearing ratio being 6·3 to 1. This alteration was made to both deep-water machines and brought immediate improvement. The machines have since given complete satisfaction and we believe they could not be surpassed for oceanographical work. They start easily under any conditions, can on an average haul 1000 m of wire in $5\frac{1}{2}$ min.[2] and can be throttled down to the slowest possible movement, so that an instrument attached to the wire can be brought without the least trouble to the exact height required. It may be noted that these machines, with 6·3 to 1 gearing ratio and with the drum full of wire, can just lift a dead weight of $5\frac{1}{2}$ cwt.

[1] That is to say, with 3000 m. of wire, 3 reversing water bottles and a 28-lb. lead.

[2] With a series of Ekman reversing water bottles the rates of hauling were approximately:

From 4000 to 3000 m.	...	7 min.
„ 3000 „ 2000 „	...	6 „
„ 2000 „ 1000 „	...	5 „
„ 1000 „ surface	...	4 „

The drums carrying 500 fathoms of wire are 16 in. in extreme diameter and 5 in. in clear width; those with 3500 fathoms of wire are 28 in. in diameter and $9\frac{3}{4}$ in. in width. The centre hub in all the drums is 6 in. in diameter. The drums are a little small for the length of wire they are intended to carry; the full amount can only be accommodated when wound on under considerable strain, and to do this on board ship is a task of some difficulty. The drums are of cast steel with the ends strengthened with radiating ribs. They are clutched to the engine and are fitted with large band brakes, operated by a foot lever which can be locked when desired by means of a screw clamp.

Outboard Platforms, Samson Posts, Booms, etc. It has already been explained that in view of the pronounced "tumble home" of the ship's side it was necessary to work from outboard platforms, but this does not apply to the apparatus for deep water bottles on the forecastle head. The wire from this machine is led through snatch-blocks to the anchor davit, and the instruments are lowered into the water close to the bow, where the sheer is ample. With the other two machines, platforms, fitted with movable stanchions and chains, are hinged to the covering board, folding against the bulwarks when not in use.

When designing the equipment it was felt that the "tumble home" would also prove a difficulty in another way, for it seemed probable that if the wire were not to foul the ship's side during heavy rolling, it must be slung so far out that it would be beyond the reach of the man on the platform. To obviate this difficulty a samson post, 4 in. in diameter and 9 ft. 10 in. in length, is stepped in the rail and a boom of the same diameter and $10\frac{1}{2}$ ft. in length is hinged to the covering board opposite each of the drums of the two after machines. The boom is fitted with a sheave at the end and its topping lift passes through a fair-lead in the samson post to a small drum which can be turned by hand and locked in any position by ratchet and pawl. With this method the inclination of the boom, and consequently the distance of the wire from the ship's side, can be regulated to suit the prevailing conditions: in heavy weather the boom can be inclined well outboard and can be topped up to bring the wire within reach of the operator when the apparatus is at the surface. The arrangement is indicated in Fig. 1. In actual practice it was found that there was less danger of apparatus being damaged against the ship's side than was anticipated and that the use of booms and topping lifts was scarcely necessary. With the shallow-water machine they were, however, retained, with the addition of a fair-lead consisting of a box of four small rollers, to prevent the wire jumping out of the jib sheave. At the after machine a high davit was substituted (Plate XI, fig. 1) and this simpler arrangement, which permits the use of a slung block for the jib fair-lead, is to be preferred.

Light Accumulators. Light compression springs or accumulators, designed to take up sudden jars and minimise the effect of the rolling, are fitted to all the machines and in general design are somewhat similar to those used by Dr Schmidt in his oceanographical expeditions to the Mediterranean.[1] The plan adopted for the two after

[1] Schmidt, *Rep. Oceanogr. Exped. Mediterranean*, 1908–10, I, p. 10, fig. 7, 1912.

machines is seen in Fig. 1. It will be noticed that the recording sheave is hung low down on the samson post, in which position it can easily be read and the indicator

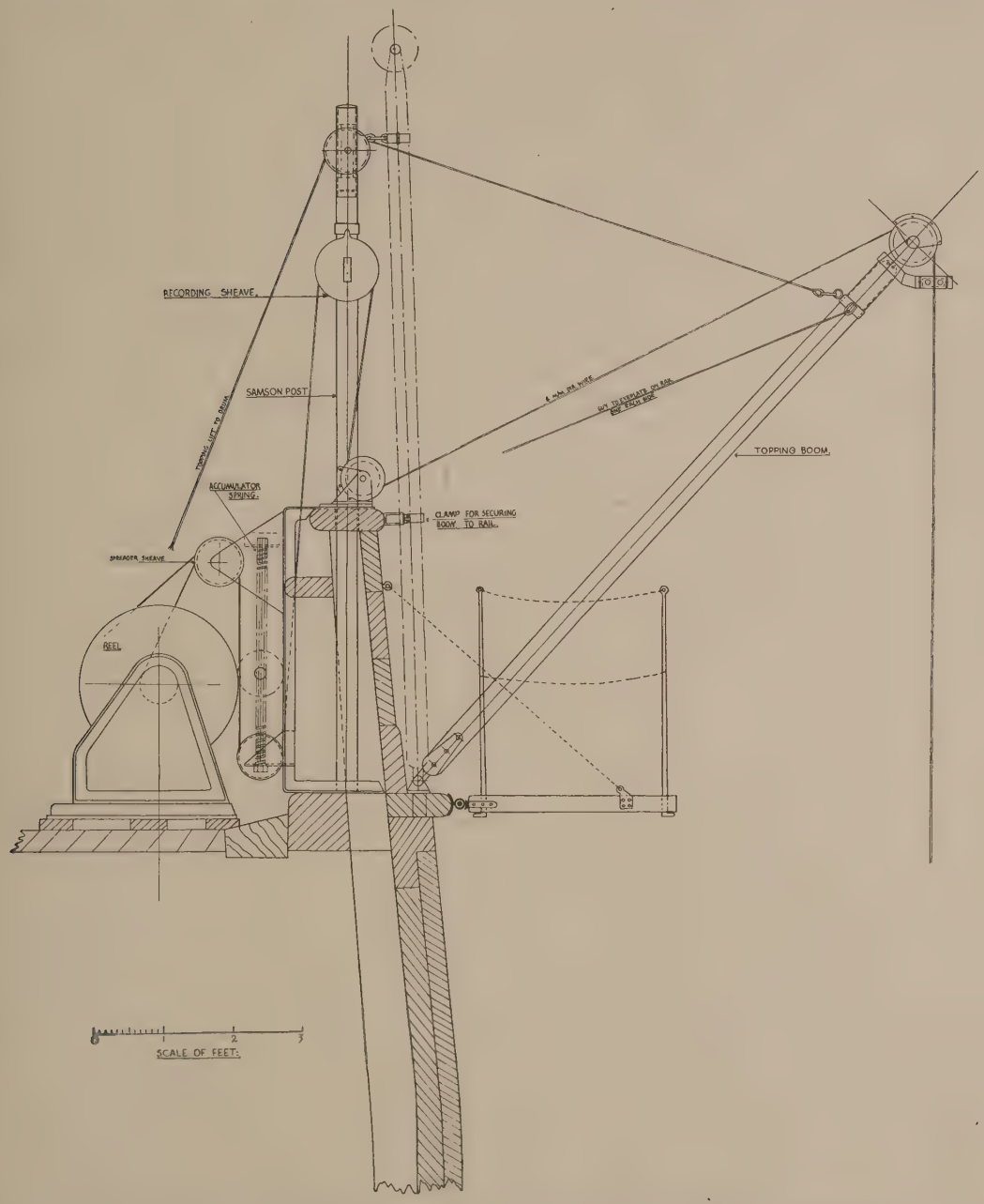


Fig. 1. Section of rail of R.R.S. 'Discovery', showing light deck machine for hydrological or plankton work, with arrangement of boom, outboard platform, accumulator, etc.

adjusted when necessary. For vertical nets in particular a considerable distance between water level and jib sheave is required, and if the recording sheave were slung from the

head of the davit it would be difficult both to read and to adjust. For the lead from the forward machine on the forecastle head the anchor davit is employed, with a removable frame carrying the accumulator, and here, as shown in Plate XIII, fig. 2, the recording sheave is slung from the davit head. The sheaves used as fair-leads are all interchangeable: they are 8 in. in diameter and are made of cast steel with a brass bushing.

In the machine used for vertical plankton hauls it was hoped that the accumulator would tend to reduce inequalities in the speed of hauling due to the rolling of the vessel, and that with its help an even rate of 1 m. per second could more easily be maintained. As will be seen, however, from the diagram, the arrangement adopted involves the use of a number of sheaves, and it was found by experience that, if the wire was to be paid out rapidly without over-riding the sheaves, it was essential to use a comparatively light spring on the accumulator. With the greater strain of hauling this spring was always in full compression, and though a moderate amount of compensation for rolling was afforded by the engine itself (which slowed automatically as the vessel rolled to starboard), the accumulator gave no assistance. But though the accumulator thus had little value for the purpose for which it was primarily intended, it proved of benefit in other ways, for the wire could be paid out more rapidly and, except in the roughest weather, it indicated by a sudden extension the exact moment when the messenger effected the closure of the net. It was thus easy to observe whether the apparatus had worked properly and whether the vertical haul had been taken to the desired level. With the machine used for the Nansen-Petterson water bottle the accumulator was useful in the same way: it indicated the time of arrival of the messenger and hauling could begin at once.

As originally constructed the arrangement for spreading the wire as it was wound on the drums consisted of a sheave (Fig. 1) running freely on a shaft whose length was equal to the breadth of the drum, the sheave being moved from side to side by a forked lever. In the forward machine this fitting was replaced, at an early date, by a small carriage with three rollers (one horizontal and two upright) moved by a worm gear. A similar method would have been advantageous with the two other machines, for when being paid out, the wire showed a tendency to jump the sheave. The sheave at the bottom of the accumulator was also loose on its shaft and was free to move laterally for half the distance of that used for spreading the wire. By this arrangement a straighter lead was maintained, but the wire was still liable to over-ride the lower sheave, and to prevent this happening two cheek-plates with small rollers were fitted.

The **Recording Sheaves** used in the 'Discovery' to indicate the amount of wire paid out are of two kinds. For the heavy wire ropes carried on the main winch a large sheave was fitted on either side of the winch-house (Plate IX (46); pl. X, fig. 2), lying in the path taken by the wire in its passage from the outer pedestal fair-lead to the stern fair-lead. Each sheave is of brass, $1\frac{1}{2}$ m. in circumference, and actuates a Hardinge revolution counter through bevel gearing. Close contact is ensured by two

subsidiary sheaves, so arranged that the wire is slightly deflected in its passage aft. This system has worked extremely well, but has the disadvantage that it will not permit the passage of shackles and swivels. When, as in trawling, it is required to wind the bridles on to the drum of the winch it is necessary to "hang off" the wire with chain strops. This could be obviated by mounting the counter on one of the pedestal fair-leads, though the accuracy would not be so great, owing to the smaller diameter and the tendency to wear.

The recording sheaves used with light wire on the plankton and hydrographic machines were slung sheaves of a comparatively cheap type; they were found to require continual attention, one of the principal difficulties being that the toothed wheel conveying the movement from the axle was insecurely attached to its shaft. The reverse direction of movement in alternate dials is also an inconvenience and the more expensive types in which this defect is overcome are to be preferred.

The **Wire Ropes** used are all of galvanized steel. The two light ropes were made by Bullivant and Co., Ltd., and the heavy warps by Thos. and Wm. Smith, Ltd. All have proved very satisfactory. The specifications of the ropes are as follows:

Purpose for which used	Vertical nets and water bottles	Fish traps, light plankton nets, etc.	Trawling, dredging and large plankton nets	Large plankton nets
Diameter (mm.)	4	6	13	12–14
Circumference (in.) ...	$\frac{1}{2}$	$\frac{3}{4}$	$1\frac{5}{8}$	$1\frac{1}{2}$–$1\frac{3}{4}$
Strands	6 × 7	6 × 7	6 × 17	6 × 12 6 × 17 6 × 19
Breaking strain	19·9 cwt.	45·5 cwt.	9·9 tons	7·3–11 tons
Weight per 100 ft. (lb.) ...	3·7	8·6	41	40 (average)
Lengths used (fathoms) ...	500 3500	25 × 120 3500	1000	5000

The long length of tapered rope is made in three sections, the reduction in diameter being effected by dropping wires at varying points spread over a long distance. In deep-water work, wire ropes are subject to stresses which approach the breaking strain more nearly than in any ordinary commercial use, and since a considerable part of the available strength is absorbed by the mere weight of wire outboard, the advantages of a tapered rope are manifest. The short lengths, 6 mm. in diameter, have an eye spliced at each end and can be connected by shackles. They are used for fish traps, the rope being unshackled and attached to the buoy when a sufficient length has been paid out.

For greasing wire ropes a mixture of 50 per cent tallow and 50 per cent castor oil was applied hot, forming a durable coating which partially filled up the lay. In cold weather it was liable to become too hard and to fall off as a powder, but this can be prevented by increasing the proportion of castor oil. This method gave excellent results,

though we have since seen it stated that if tallow becomes rancid, free organic acids are developed which have a detrimental effect on wire ropes.

For determining strains a Salter **Dynamometer**, reading to a maximum of 6 tons, was used in conjunction with the nipper referred to on p. 207. With this apparatus it is, of course, only possible to read the dead weight or towing strain. With series of water bottles and with any open plankton nets the hauling strain is the greater, and this could only be registered by an instrument similar to the "tensimeter" sometimes used in aeronautical work.

The following examples of the strains recorded with the dynamometer may be given:

(i) With a 28 lb. sinker, three reversing water bottles and 3000 m. of 4 mm. wire: dead weight $2\frac{3}{4}$ cwt.

(ii) With a 100 lb. sinker, one $4\frac{1}{2}$ m. tow-net and 1800 m. of $1\frac{5}{8}$ in. wire rope, speed 2 knots: towing strain 22 to 27 cwt.

(iii) With a 100 lb. sinker, two Petersen young-fish trawls attached to 2 m. frames and 5000 m. of tapered warp, speed 2 knots: towing strain 41 cwt.

(iv) With a 40 ft. otter trawl working at depths of 250 to 350 m., with 800 to 1000 m. of $1\frac{5}{8}$ in. wire rope, speed 2–3 knots: average towing strain 18 to 24 cwt., rising occasionally on heavy ground to 31 cwt.

The **Sounding Machine**, of the well-known Lucas type, is placed on the port side of the forecastle head abreast of the hydrological machine (Plate XIII, fig. 1). The machine with its engine is mounted on a bedplate, fitted on a pedestal elevated above the deck, and so arranged that when not in use the whole machine can be brought inboard by means of screw gear fitted under the pedestal. The iron framework seen in the figure is for the support of a canvas cover. The drum of the sounding machine is $14\frac{1}{2}$ in. in extreme diameter, the hub $8\frac{1}{2}$ in. in diameter, and the width $5\frac{1}{2}$ in. The drum carries 5000 fathoms of single-strand piano wire.

The machine is driven by a Brotherhood 3 cylinder reversing engine, with cylinders set radially at equal angles of 120 degrees, all working on a common crankpin on the well-known Brotherhood principle. The cylinders are of 4 in. diameter and $2\frac{1}{2}$ in. stroke, and the drive from the engine to the sounding drum is by means of machine-cut gearing, the ratio of the gears being 2·4 to 1.

In bad weather the 'Discovery' rolled heavily and in a strong wind she drifted fast to leeward. In such circumstances sounding often proved a matter of great difficulty, and on a number of occasions the wire parted and the sounding tube was lost. These difficulties, however, were due to the conditions, the machine as a whole proving very satisfactory. One defect was the absence of a clutch. The gear wheel was secured to the shaft carrying the sounding drum by means of a set screw, which was removed at the beginning of sounding operations to allow free motion to the drum and inserted when bottom was reached. The engine was a little fierce in starting, and though it was always run free before hauling began, the delay occasioned by the adjustment of the set screw often prevented an easy start and the sudden jerk sometimes caused the

wire to part. The fork for guiding the wire on to the drum did not prove satisfactory, and was replaced by a guide formed of three small rollers (two vertical and one horizontal) fitted to a transverse bar and moved by a lever.

The wire used is single-strand piano wire, 0·028 in. in diameter and with a breaking strain of 220 lb. Experiments were also made with a fine 7-strand wire 0·039 in. in diameter with a breaking strain of 250 lb.: it was found that the 7-strand wire was very perishable and its use was discontinued.

A Kelvin sounding machine, driven by electric motor, was fitted on the poop deck. This machine can be employed in the ordinary way for determining the depth when the vessel is stationary, and with the use of the well-known Kelvin tubes, reliable soundings can also be taken while the vessel is under way. As an aid in navigation it is a most valuable instrument and it was frequently used for taking soundings in the course of scientific work. The machine is provided with a dial which indicates the amount of wire run out, and the wire itself is $\frac{1}{16}$ in. in diameter, composed of seven strands of 24 S.W.G., and has a breaking strain of 280 lb.

The internal accommodation for scientific work on board the 'Discovery' comprises two laboratories, a darkroom, two holds, and a locker in the topgallant forecastle.

The **Biological Laboratory**, as already mentioned, is placed on the upper deck, at the after end of a deck house which also contains the chart room, a spare cabin and the wireless operator's room. It has a door on either side to the deck, and one leading into a vestibule at the head of the companion to the wardroom. The general arrangements are sufficiently well shown in the sketch (Fig. 2) and plan (Fig. 3), but one or two points perhaps deserve special mention.

The portholes are 14 in. in diameter and are placed much lower than usual, $3\frac{1}{2}$ in. above bench level, in order to give the best possible light for microscopic work; and, in view of the large amount of bench space that would have been taken up by their dead lights and screw clamps, those on the after bulkhead are reversed and are opened and closed from the outside. The benches give seating accommodation for four and are so placed that those using the centre table face thwartships, a position which is preferable for work in a rolling vessel. The chairs of the two side benches have folding backs; they run on brass rails flush with the deck and can be pushed under the bench when not in use. All microscope stands are drilled and can be bolted to a brass plate countersunk in the bench surface.

The swing table, 20 in. by 33 in., is built of teak, with iron stays carrying a tray below the table and a lead weight of 56 lb. This table was a very essential part of the equipment: except in the calmest weather it was in constant use. It would have been improved with more space round it. Two small swing tables, bracketed to the after bulkhead between portholes, were useful for small dishes of specimens.

The sink is supplied with fresh and salt water from two small tanks placed on the bridge, and above it, in an alcove built out over the companion, are three 20 litre glass

Fig. 2. The Biological Laboratory in the R.R.S. 'Discovery', seen from the port door.

A wide-angle view to show both sides of the laboratory: to obtain the correct perspective and idea of size, bend the page in a semicircle.

jars containing 75 per cent spirit, 10 per cent formalin and formalin of full strength. The supplies from these jars are led by rubber pipes to glass taps, mounted close together on a wooden base.[1] The jars are refilled by means of a small Merryweather hand pump, provided with rubber intake and outlet pipes. In practice this arrangement proved very convenient, but much labour would have been saved if it had been possible to accommodate larger jars. Successful hauls yielded vast quantities of material, and even when all the larger animals had been separately accommodated in tanks or stoneware jars, 20 litres of spirit frequently proved insufficient. The dilute formalin jar also had to be refilled continually during plankton investigations.

The rack for bottles, shown in Figs. 2 and 3, added greatly to the efficiency of work in confined quarters. It is built over a set of baize-lined drawers in which tubes were stored, and holds, in felt-lined pigeon-holes inclined at an angle of 20° from the horizontal, all the types of bottle used for the preservation of specimens. The main supply of bottles was kept in one of the holds, packed in felt-lined boxes, and in the rack

[1] The arrangement shown in Fig. 3 was found inconvenient and was modified at an early date to that shown in Fig. 2.

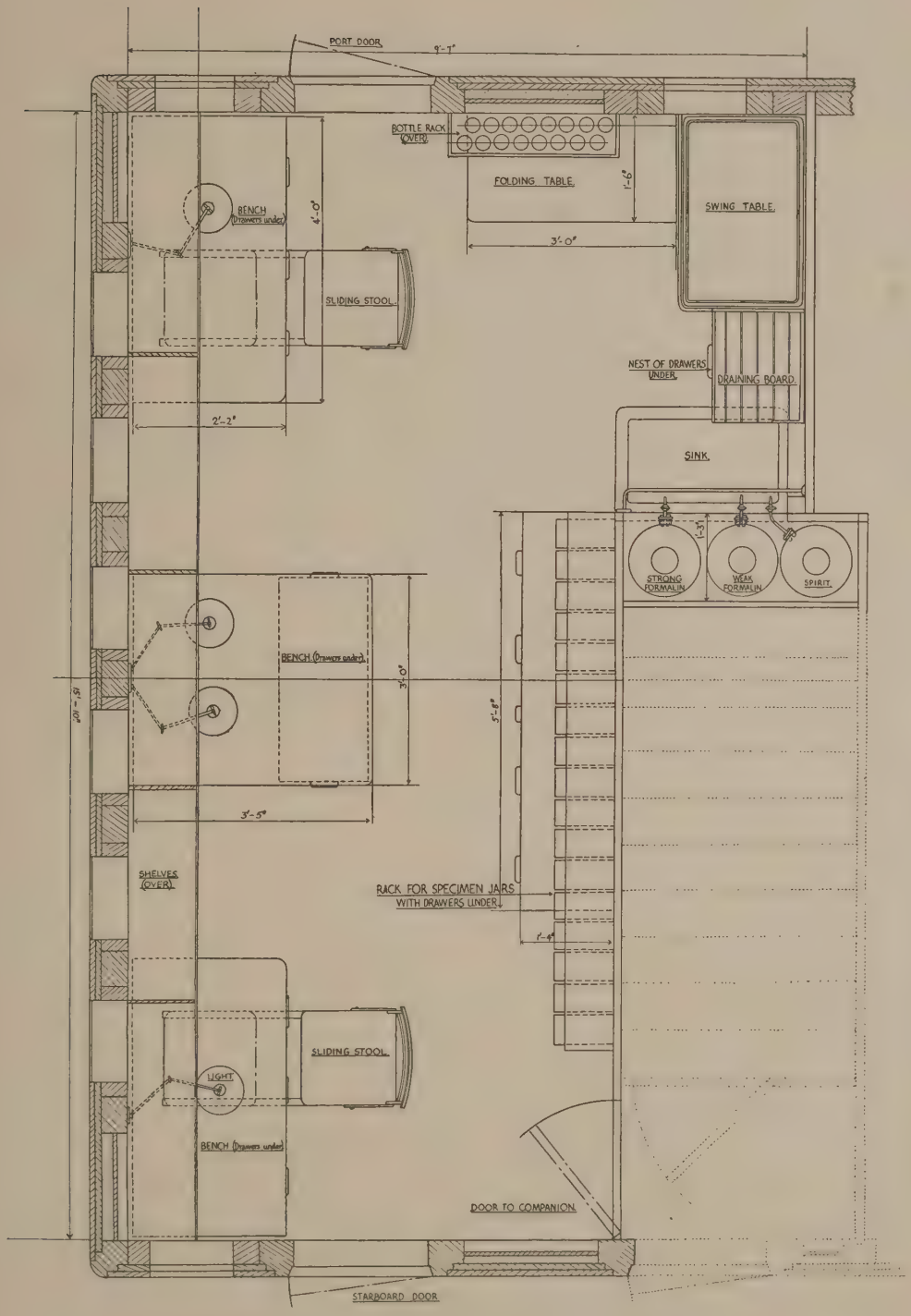


Fig. 3. Plan of Biological Laboratory in the R.R.S. 'Discovery'.

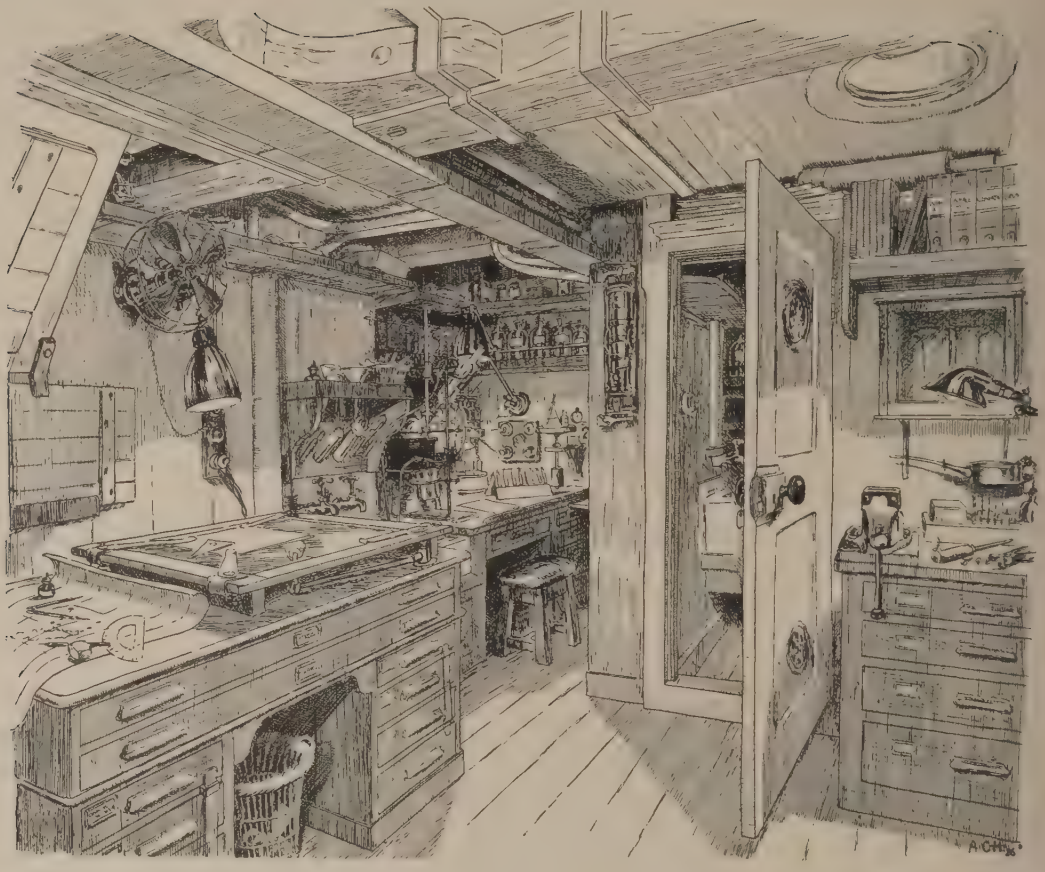


Fig. 4. The Chemical Laboratory in the R.R.S. 'Discovery': a view taken from the point marked * in Fig. 5.

there is room for more than a boxful of each size. When it was found that only a few empties of a particular size remained in the rack, a fresh box was brought up from the hold and empty and full bottles interchanged. Large specimen tubes, 12 to 24 in. in length, were stowed in a special rack built behind two of the bookshelves on the after bulkhead, the tubes, when wanted, being withdrawn from below. A row of lockers above the bottle rack was useful for miscellaneous articles.

The numerous other fittings used need not be mentioned in detail. Bars were required to keep books on their shelves and to prevent thwartships drawers from opening, while special chocks, brackets and racks were necessary for glass bowls, dishes and tubes, measuring cylinders, reagent bottles, trays, Kelvin tubes and other apparatus. At first it seemed that to accommodate all necessary gear would be impossible, but eventually a place was found for everything. Tidiness in such cramped surroundings was essential and breakages were inconsiderable, even in the worst weather.

The **Chemical Laboratory** (Figs. 4 and 5) is used for the chemical work and serves also as a workshop. It contains in addition to a work bench and large chart table,

drawers, bins and cupboards for the storage of glassware and other gear. A small portion is shut off to form a darkroom, and both darkroom and laboratory are provided with sinks and supplies of fresh and salt water.

The chemical work was done in a very confined space, with stands for burettes and other apparatus screwed to the bench. Here the hydrogen-ion concentration of sea water was determined throughout the voyage, and, during the last year, all titrations

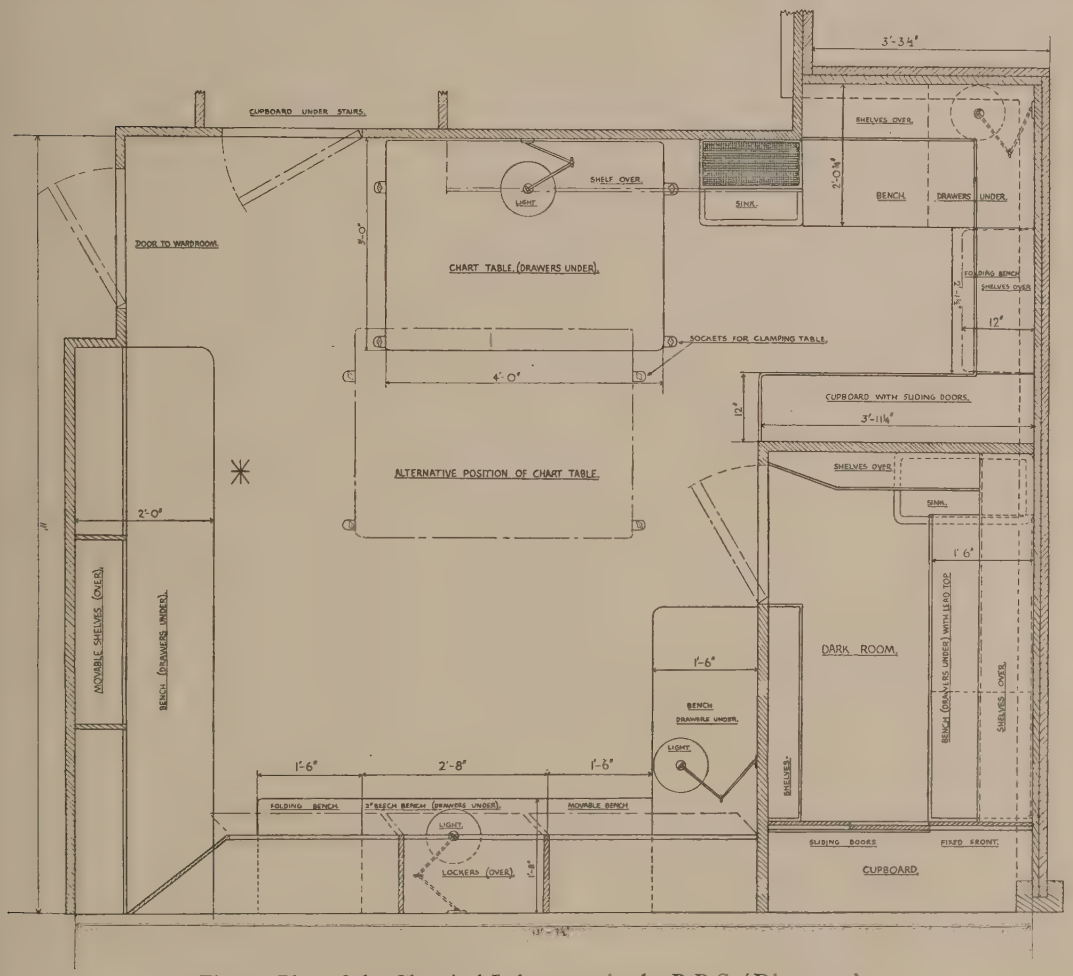


Fig. 5. Plan of the Chemical Laboratory in the R.R.S. 'Discovery'.

for salinity were also made on board. On the chart table a chart-tracing table was fitted, constructed to a design kindly given us by Lieut.-Comdr. J. R. Lumby. This apparatus consists of a heavy sheet of plate glass, mounted in a wooden frame and lighted from below by an electric lamp which can be moved anywhere in a horizontal plane. With it tracings can be made on thick paper, clips suitably mounted on the sides of the frame serving to keep the sheets adjusted while the work is in progress. A chemical balance is screwed to the bulkhead, but could, of course, be used only when the ship was in

harbour. A Hearson electric oven, an electric hotplate and a Primus stove with water bath are also provided. The small workshop was in constant use for the adjustment and repair of scientific apparatus. The darkroom is 4 by 6½ ft. and has a sink, a lead-covered bench and other usual fittings.

THE RESEARCH STEAMSHIP 'WILLIAM SCORESBY'

CONSTRUCTION, ACCOMMODATION AND MACHINERY

As already explained this vessel was constructed to carry out investigations of three different kinds. She was to assist the 'Discovery' in routine observations on plankton and hydrography, to make trawling surveys in the neighbourhood of the Falkland Islands with a full-sized commercial trawl, and to undertake experiments in marking whales. In designing a ship for these varied purposes special consideration had to be given to the intended work of whale-marking. For this a vessel of high speed, able to turn with great rapidity, was essential, and it was decided that the design so far as practicable should follow that of a modern whale-catcher. An additional consideration was the need for very large bunker capacity, for it was realized that in the course of her work the vessel would be required to make direct passages between Cape Town and the Falkland Islands.

Construction. The vessel as finally designed was larger and more powerful than most whale-catchers. This was necessary to enable her to carry an exceptionally large amount of oil fuel and to attain a reasonably good speed, and also to accommodate the personnel which the work demanded. In other respects the vessel differs from most whaler-catchers in that she is considerably stronger in construction; her framing at the forward end is specially closely spaced and the bow plating doubled for a large extent of the forward part of the underwater portion of the vessel. In addition a doubling of steel plate extends throughout the length of the vessel at the water line. These special features are intended as protection against ice. The stem and rudder frame are also designed for encounter with ice, both being rabbeted or recessed so that the edges of the plating are protected against chafe.

The vessel was built by Messrs Cook, Welton and Gemmell, Ltd., and her principal dimensions are as follows:

	ft.	in.
Length over all	134	0
Length on water line	125	0
Beam moulded	26	0
Depth moulded	14	6
Designed draught	13	6 aft
Designed speed 12 knots		

When the ship returned to England after her first commission a few minor alterations were made. Her general arrangement, as now in service, is described below and is

illustrated in Plates XIV–XVI. The equipment for scientific work is dealt with separately on p. 178.

At the forward end of the **Upper Deck** there is a short forecastle head, providing a platform, protected at the bow by a stout wooden bulwark, from which whale-marking experiments can be undertaken. At the after end of the forecastle a 16 in. searchlight projector is fitted on an elevated pedestal.

Immediately abaft the forecastle head is a steam and hand capstan, the base of the capstan head being fitted with a gypsey for dealing with the vessel's cables. The main-mast is of extra heavy steel construction, suitable for whaling if required, and is fitted near the centre of the fore deck. Immediately abaft the mast is a combined steel companion way and skylight, giving entrance and lighting to crew space, chart room and officers' quarters below deck. A large steam winch of special design is fitted at the after end of the fore deck. On the starboard side of the fore well deck, abreast of the main-mast, are the Lucas sounding machine and the hydrological reel, both driven by the same compound surface condensing engine. This machine and the winch are separately described on pp. 178, 179.

Immediately forward of the boiler casing the laboratory is constructed. It is built of teak, fitted with unusually large port lights, the construction being similar to that adopted for the deck houses in the 'Discovery'. Above the laboratory is the navigating bridge, with a teak wheelhouse to enclose the helmsman. The forward part of the bridge is extended out to the sides of the ship to enable the officer of the watch to see fore and aft on either side when coming alongside, and this extension is supported on heavy teak beams. The wheelhouse contains an echo-sounding installation for depths not exceeding 130 fathoms, in addition to a Kelvin liquid card compass and the engine-room telegraph. The roof of the wheelhouse is surmounted by a small bridge, upon which the standard compass is fitted, enclosed by brass rails and stanchions. Portable awnings are arranged above the navigating bridge and standard compass position and a Morse signalling lamp is fitted forward of the compass.

The engine and boiler casings, which are of steel, extend over practically the whole length of the engine and boiler space. On top of the casing between the funnel and the engine-room skylight a steel house is constructed for the wireless installation. The wireless installation is similar to that fitted in the 'Discovery', and consists of a Marconi quench-gap installation and a continuous wave set, both of $1\frac{1}{2}$ kw. capacity. In order to give quieter working conditions the alternator was fitted in the engine room, instead of in the wireless house as is customary.

The engine-room skylight is fitted immediately abaft the wireless house on the top of the engine casing, and is of steel with brass frames for the glass. This type of skylight was specially selected as suitable for both tropical and Antarctic conditions. At the after end of the engine casing on the main-deck level, room is provided for the steam steering gear, which is thus immediately under the eye of the engineer on watch. The galley is arranged at the extreme aft end of the engine casing and is divided from the

steering-gear room by a thwartships alley way: this alley way has doors on both sides of the ship and affords sheltered access to the engine room as well as to the wardroom lobby and galley. Abaft the after end of the boiler casing, which is wider than the engine casing, small rooms are constructed on each side: the rooms on the starboard side are arranged for deck stores and lamp room, and on the port side as the crew's washhouse.

Abreast of the starboard side of the engine casing and fitted on the upper deck is the plankton reel, coupled to a compound surface condensing engine. This machine is described on p. 179.

On the after deck, abaft the galley, is a large teak skylight above the wardroom and living rooms. Hand-screw steering gear is provided immediately above the rudder head as a stand-by, and the usual gratings are fitted at the stern of the vessel above the steering quadrant and chains. Advantage was taken of the room below the gratings to fit small freshwater tanks for increasing the drinking-water supply. Four specimen tanks are secured on the starboard side of the after deck and one on the port side. The trawl gallows are on the port side of the vessel and are suitable for working a full-sized commercial trawl. The usual pedestal fair-leads are fitted on the fore deck for working the trawl in conjunction with the steam winch.

The following ship's boats are provided: two teak lifeboats, each 20 ft. long, 7 ft. beam and 3 ft. depth, carvel built, constructed to Board of Trade requirements and fitted under special davits arranged to pivot outboard from the casing sides. The latter arrangement is provided to keep the davits clear of the ship's rail for trawling and other purposes. A small teak dinghy is fitted on skids abreast of and level with the top of the galley and steering-gear houses. The davits for this dinghy are of the ordinary type, fitted on the starboard side.

Below the Upper Deck the vessel is subdivided transversely into six compartments by means of three watertight and two oiltight bulkheads. Forward of the collision bulkhead is a store room for ship's gear. Abaft the collision bulkhead is crew space, with accommodation for twelve men, to which access is obtained by a companion leading to a small lobby near the main-mast. Leading from this lobby is a small petty officers' mess room on the starboard side and a large chart room at the after end. Opening off the chart room are four cabins, two on either side, for junior officers, each with two beds. Forward of these cabins there is on the starboard side the steward's cabin, entered by way of the petty officers' mess room, and on the port side a scientific store opening on to the lobby.

The space below the forward accommodation is arranged with shelves, racks and bins for the storage of provisions, ship's gear and scientific stores. The forward end is partitioned off to form a chain locker.

Immediately abaft the forward accommodation the fuel bunkers are constructed. These bunkers have a capacity for 145 tons of oil fuel or 120 tons of coal. They are divided into four compartments: a cross bunker forward of the boilers with oiltight

division on the fore and aft centre line, and two wing bunkers, one each side of the boiler space. This arrangement enables oil to be used from the cross bunker in the first place, thus easing the vessel's trim when making a long passage such as that from Cape Town to South Georgia. Directly abaft the fuel bunkers, and on each side of the boiler, freshwater feed tanks are constructed, having capacity for a total of 11 tons of feed water

The wardroom accommodation is situated immediately abaft the engine room, between the engine-room bulkhead and the aft peak bulkhead. The wardroom occupies the port aft portion of the space and, for a small ship, is very commodious: it is furnished and panelled in polished mahogany. Two single-berth cabins (those of the chief engineer and chief officer) are placed on the starboard side of the ship and open into the wardroom. Forward of the wardroom a lobby is provided, giving access to the cabin of the senior scientific officer on the starboard side and to that of the captain on the port side. At the forward end of the accommodation space there is a small store room and a refrigerating chamber on the starboard side, and on the port side a bathroom. Between these is the wardroom pantry, with a small service lift communicating with the galley on the main deck.

Below the after end of the wardroom accommodation a small aft peak tank is provided, having a capacity for about 1 ton of fresh water. The remainder of the space below the accommodation is divided into provision stores, bonded locker and freshwater tanks, the latter having a total capacity of 800 gallons.

Machinery. The main boiler is practically amidships, with the main engines immediately abaft it, separated by a screen bulkhead. The boiler is of the cylindrical marine type, 15 ft. 6 in. in diameter and 11 ft. 6 in. long, working at a pressure of 180 lb. per square inch. The main engines are of the ordinary triple expansion surface condensing type, having cylinders 16, 27, and 40 in. in diameter with a common stroke of 30 in. They are designed to develop 1050 H.P. when working at 120 revolutions per minute.

The oil-fuel installation is of the Wallsend-Howden type; the gear is in two separate units, either of which is capable of supplying the necessary fuel independently. Forced draught is supplied by means of a Howden forced-draught fan fitted in the engine room, with air casings trunked through into the stokehold.

The auxiliaries in the engine room are as follows: a centrifugal circulating pump with an all gunmetal casing driven by a single cylinder steam engine; a Weir's multiflow surface feed heater, using exhausts from auxiliaries; a Weir's feed pump with automatic feed control; a Caird and Rayner's 10-ton evaporator and distilling plant, and a Caird and Rayner's feed-water filter. The air pump, main feed pumps and bilge pumps are driven by levers from the main engines.

ARRANGEMENTS FOR SCIENTIFIC WORK

On board the 'William Scoresby', a smaller vessel, arrangements for scientific work are necessarily of a simpler character than in the 'Discovery'. Apart from the main winch there are only two auxiliary deck machines—one of which also drives the Lucas sounding machine—and there is only a single laboratory.

The **Main Winch** (Plate XVII, fig. 1) was specially constructed to carry three drums of wire rope: two of these are required for the heavy warps used with the otter trawl, and one, placed in the centre, for a long length of light rope employed in plankton investigations.

The winch is of the horizontal type and was made by the Strath Engineering Works of Aberdeen. The cylinders are of 9 in. diameter and 14 in. stroke, working at the full boiler pressure of 180 lb. to the square inch. The side and centre frames are of cast steel, and clutches, fitted on machined squares, are provided, so that any one drum can be used independently. The three main drums are each 48 in. in diameter and 33 in. between flanges, built up with cast steel hubs and mild steel end plates. The two side drums each hold 1000 fathoms of trawl warp, $2\frac{1}{2}$ in. in circumference, while the centre drum carries 3500 fathoms of rope, tapering in circumference from $1\frac{1}{8}$ to $1\frac{5}{8}$ in. Warping drums are fitted at each end of the main shaft. The piston rods and valve spindles are of manganese bronze, the latter being specially large to resist heavy wear and exposure. Drain cocks, lubricators and other necessary fittings are suitably arranged for service in the Antarctic. The reversing gear is of the link type. An independent brake, lined with wood and operated by screw gear, is fitted to each drum, and hand traversing gear is provided for guiding the wire on to the drums. The whole winch is assembled on a cast-iron bedplate, which is seated on a pitch-pine bed on the fore deck immediately forward of the laboratory. The weight of the winch without wire ropes is about $10\frac{1}{4}$ tons: with the three drums full of wire rope the total weight is about $18\frac{1}{2}$ tons.

Apart from being a little fierce in its action the winch has proved very satisfactory, giving no trouble in the course of long and continuous service.

In trawling operations the ropes from the port and starboard drums are led by fair-leads of the usual pattern to the gallows on the port side of the vessel, the arrangement being closely similar to that found on commercial trawlers. The cod-end of the trawl is lifted by a purchase from the main-mast on to the fore deck, where a pound is placed to receive the catch. In plankton operations with horizontal or oblique nets the boom of the main-mast is guyed over towards the port side, and the wire rope from the centre drum is led to a recording sheave slung at its foot. The rope then passes by way of a snatchblock at the head of the boom to the port quarter, and as soon as the nets have been shot, it is triced up in this position. The topping lift of the boom is attached to a large spring placed vertically on the forward side of the mast. By this arrangement, which acts as an accumulator, a certain amount of play is given to the boom and to the rope which it carries.

The two **Light Deck Machines** are placed on the starboard side of the vessel, one of them on the fore deck opposite the main-mast, and one further aft, abreast the engine and boiler casing. Both these machines are equipped with the same type of engine, made by Philip and Son of Dartmouth. The engine is of the compound enclosed type, with cylinders 4 and 8 in. in diameter and a common stroke of 5 in., working at a maximum of 600 revolutions a minute with a boiler pressure of 180 lb. to the square inch. Each of these engines is coupled to a drum which carries 3500 fathoms of light wire, 4 mm. in diameter. The drum is strongly constructed of cast steel; the centre hub is 8 in. in diameter, the extreme diameter over flanges is about 29 in., and the clear width between flanges is 10 in. With these dimensions the full amount of wire is easily stowed. The connection between the engine shaft and the gearing for driving the drum is by means of an ordinary dog clutch. The main spur wheel is bolted to the side of the drum, and the pinion wheel, driven direct from the engine shaft, gears with the spur wheel, giving a single purchase drive with a ratio of 5 to 1. A band brake operated by a foot lever is fitted, and is so arranged that the drum can be locked when desired. A fork, fitted with rollers and operated by hand-driven screw gear was originally provided for spreading wire on the drum. This fork proved unsatisfactory and it was replaced by a small traveller carrying three rollers—two vertical and one horizontal.

The after machine consists of the engine and drum described above and is used for vertical plankton nets. The forward machine is for hydrological work, and the engine, in addition to driving the drum of 4 mm. wire, is coupled on its forward side to a sounding machine (Plate XVII, fig. 2). The three units composing this machine are mounted on a common bedplate. The sounding machine is connected with the engine by means of a dog clutch and is driven by machine-cut bronze gearing.

During the first year of service it was found that in cold weather the drainage of the engines was insufficient, resulting in damage to the cylinders. On renewal larger drains and relief valves were fitted and the engines have since given no trouble.

In the 'William Scoresby' the operation of vertical nets and water bottles is more easily effected than in the 'Discovery'. Opposite each machine a davit is stepped in the rail, the wire from the drum leading direct to a recording sheave slung at the davit end. Accumulator springs of the type employed in the 'Discovery' were not fitted; instead, the recording sheave is attached to a long pin which passes through a hole in the end of the davit and is supported on the upper side by a compression spring. This device is not very effective, for the spring is too short to give sufficient play to the wire.

The **Recording Sheaves** for the plankton and hydrological machines are of the same pattern as in the 'Discovery' and showed the same defects (p. 167). A sheave of different pattern is used with the centre drum of wire rope on the main winch; it was supplied by the Laboratoire Hydrographique at Copenhagen and is of the heavy type described by Knudsen in 1923.[1] This sheave is of the most solid construction and has proved very satisfactory.

[1] Knudsen, *Pub. Circ., Cons. Explor. Mer*, 77, p. 14, 1923.

The **Wire Ropes** were made by the same firms that supplied those of the 'Discovery' and are to the following specifications:

Purpose for which used	Vertical nets and water bottles	Horizontal nets	Trawling
Diameter (mm.)	4	9–13	20
Circumference (in.) ...	$\frac{1}{2}$	$1\frac{1}{8}$–$1\frac{5}{8}$	$2\frac{1}{2}$
Strands	6 × 7	6 × 7 6 × 12 6 × 19	6 × 19
Breaking strain	19·9 cwt.	4·5–9·9 tons	21 tons
Weight per 100 ft. (lb.) ...	3·7	31 (average)	105
Length used (fathoms) ...	3500	3500	1000

The **Sounding Machine**, as already mentioned, was coupled to the engine which drives the drum used for hydrological work. It is a Lucas machine and apart from the difference in the drive is identical with that used in the 'Discovery'. In the position which the machine occupies, the jib sheave—which also registers the amount of wire paid out—extends outboard through an aperture in the bulwarks. Thus fitted it is liable to damage when the vessel is coming alongside; but the jib is portable, and can thus be removed when the machine is not required, while the aperture in the bulwarks can be closed by a sliding door. A Kelvin machine, for taking soundings in shallow water, is fitted in the stern: it is hand-driven, but otherwise similar to that in the 'Discovery'. This machine and the echo-sounding apparatus referred to on p. 175 were frequently used for taking soundings during scientific work. When trawling and dredging in coastal waters where the bottom was uneven the echo-sounding apparatus proved particularly useful. Continuous readings of the depth could be taken and the length of wire rope varied accordingly.

The **Laboratory** is situated immediately below the bridge and is 16 ft. broad and 9 ft. long. It has port and starboard doors and large portholes on three sides placed close to the level of the benches as in the 'Discovery'. On the after bulkhead, in the middle there is a sink supplied with fresh and salt water, and above it are large glass jars, fitted with taps, for alcohol and formalin. The space on either side of the sink is occupied by cupboards and sloping bottle racks. Along the forward bulkhead is a bench, extending round to the doors on either side, and interrupted in the middle by a small swing table. Above the portholes there are bookshelves and below the bench there are tiers of drawers. Three stools are provided, and a movable flap, attached to the bench, can be used as a writing desk. In bad weather it was found that the laboratory tended to become over-heated and to remedy this defect two small ventilators were fitted, opening on to the bridge.

For storage of scientific apparatus a locker is provided on the lower deck, opening off the lobby which gives access to the chart room; other scientific gear and material is stored in a hold below the forward accommodation.

APPARATUS AND METHODS

PLANKTON NETS AND APPARATUS

Six different types of plankton net were used in the investigations: a small silk net on a ring of 50 cm. diameter, a series of four nets of graded mesh, with diameters of 70, 100, 200 and 450 cm. respectively, and the Petersen young-fish trawl, which was used at first with the otter boards as a trawl proper and later as a tow-net on a 200 cm. ring. These nets will be referred to as the N 50, N 70, N 100, N 200, N 450 and TYF respectively.

The N 50 was almost exclusively used for vertical hauls, the N 70 vertically, horizontally or obliquely, the N 100 horizontally, obliquely, or very occasionally vertically, and the remainder horizontally only. All the nets could be closed, if necessary, by messengers and closing mechanisms on the Nansen principle.

Whilst differing in size of mesh and details of construction, according to their different functions, all the nets, with the exception of the TYF, follow the same general plan shown in Fig. 6. Between the ring *R* and the conical catching part of the net *BC* there

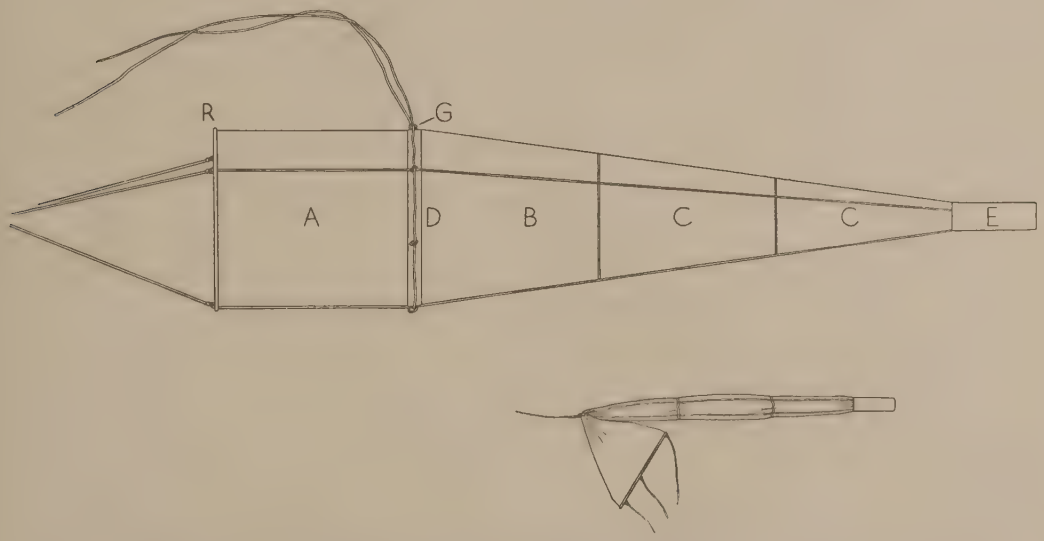


Fig. 6. Diagram of general tow-net design; for explanation see text. The smaller figure shows the net closed on the Nansen principle.

is a cylindrical portion *A*, separated from the latter by the canvas band *D*, which is fitted with small rings *G* to take a closing rope. In the nets of graded mesh the catching part *BC* is made of netting of two different sizes, the front part *B*, which is one-third of the length,[1] being of a coarser mesh than the remaining two-thirds *C*. The

[1] Except in the N 70, where the proportions are made to conform with a similar net used by Prof. Hjort in the north (see p. 183).

"cod-end" of the net tapers to join a canvas cylinder *E*, made to slip over and be clamped to the collecting bucket.

With the exception of the TYF the nets were made to our designs by the Marine Biological Association at Plymouth. They were all treated with copper-soap preservative as described by Dr W. R. G. Atkins[1], who kindly supplied much helpful advice as to the manner in which it should be applied. In spite of the fact that the nets were often kept under most unfavourable conditions, it was only on the rarest occasions that a net was found to have rotted: the use of copper soap as a preservative is strongly to be recommended.

Specifications of Plankton Nets

The design and function of each net will now be described in turn. Full details are included in order that references may be given and repetition avoided in future papers on plankton results.

The **N 50**, designed for the capture of diatoms particularly and the smaller plankton forms generally, is made of the finest bolting silk: that with 200 meshes to the linear inch. Its use formed part of the routine at each full station, a vertical haul being made with it from 100 m. to the surface at a speed not exceeding 1 m. per second. Like the N 70, next to be described, it is similar in size and mesh to that being used by Professor Hjort[2] in his plankton investigations in the northern whaling areas, so that comparisons between the conditions in the two hemispheres may more easily be made.

The ring, which has an opening of 50 cm. diameter, is made of galvanized iron, $\frac{3}{8}$ in. thick with round cross section, and has at three equidistant points a pair of small eyes of $\frac{3}{8}$ in. opening, one on each side of it, as shown in Fig. 7. These eyes form the points of attachment in front for the three bridles and behind for the lines attached to the bucket and weight. The bridles are of 3 mm. diameter phosphor-bronze rope, 3 ft. in length and with a brass eye spliced into each end. These are secured to the eyes on the ring by small shackles and drawn together at a towing shackle in front.

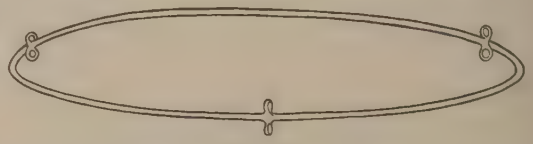


Fig. 7. Small tow-net ring.

In this net the sections *A* and *D* (Fig. 6) are continuous and of the same canvas material, making a cylinder 26 in. long. At its front edge it is sewn on to the ring *R* and behind to the conical net; on its outside are sewn six small brass rings at equal intervals, each 3 in. from its hind end, so that the net may be closed by a throttling rope if desired. The actual net, *BC*, 5 ft. 5 in. long, is of one material and tapers from a diameter of 50 cm. to one of 6 cm., where it joins the small canvas cylinder, 7·5 cm. long, for the attachment of the bucket. The netting employed is the silk bolting cloth made by Messrs John Staniar and Co. of Manchester, and known as their "No. 25

[1] Atkins, *Journ. Marine Biol. Assoc.*, n.s., XIV, p. 63, 1926.

[2] Nets of similar type are described and figured by him in Murray and Hjort's *Depths of the Ocean*, p. 46, London, 1912.

First Standard Quality Double Twist Silk", having approximately 200 threads to the linear inch. It was found that these nets, being made of such fine material, frequently split; in future they will be made with an outer cover of wide mesh netting to take the strain of the pressure when hauling.

The brass collecting bucket, which is separately described with those for the other nets on page 189, is secured to the small canvas cylinder at the tail of the net by means of a brass band and tightening screw. The wire stays supporting the bucket are of the same material as the bridles, but 9 ft. long; they are attached by small shackles to the eyes on the ring, seized to the eyes on the bucket holder and when, as usually, the net is used vertically, meet below at a shackle supporting a 7 lb. lead. The net as rigged for vertical use is shown in Fig. 8.

Fig. 8. The N 50. net rigged for vertical use.

The **N 70** net is designed for the capture of the medium and smaller sized organisms of the macroplankton, from small or young Euphausians and largest Copepods downwards, and is made with two grades of silk netting: 40 meshes to the inch in front and 74 behind. As explained elsewhere the use of this net formed part of the routine at all full stations, being used vertically and horizontally or obliquely. When used vertically it was hauled at a speed of 1 m. per second, and closed by messenger, closing mechanism and throttling rope when it had fished through the required layer. An account of the routine work with these nets will be found on pages 199–201.

It will first be described as rigged for vertical use.

The ring is similar to that used in the N 50, but has an opening 70 cm. in diameter. At first phosphor-bronze bridles were used, but when it was found that these sometimes fouled the closing mechanism on the way down, so preventing or precipitating its action, they were replaced by three brass rods. These are $\frac{1}{4}$ in. thick, 32 in. long and have an eye at each end carrying a brass ring; they are each shackled to the frame at one end and at the other meet in a shackle for attachment to the closing mechanism, thus forming a rigid tripod.

The section *A* (Fig. 6) is 21 in. long and made of strong $\frac{1}{4}$ in. mesh (knot to knot) netting. In front, where it has a rope margin, it is lashed to the frame, and behind it joins the canvas band *D*, which is 10 in. wide and has, like the N 50, six brass rings to take the closing rope. The catching part of the net *BC* tapers from this to the small canvas cylinder, 9 in. in circumference, for attachment to the bucket. It has a total length of 7 ft. 7 in., but is in two sections; the first, *B*, 3 ft. 2 in. long, is made from Messrs Staniar's "Quadruple Extra Heavy Quality Double Twist Swiss Silk" bolting cloth, No. 40, having 40 threads to the linear inch, and the second section, *C*, 4 ft. 5 in. long, from the same quality bolting cloth, No. 74, having approximately 74 threads to the linear inch.

Three phosphor-bronze wire ropes, 3 mm. in diameter, 14 ft. long and having brass eyes let in at each end, support the bucket (described on page 189) and the weight. They are shackled to the eyes on the frame and they have rings to take the closing rope, similar to and seized at a point in line with those on the net; further, to prevent their twisting round each other, they are seized to a stout brass ring 7 in. in diameter which passes round the net some 6 in. above the bucket; and finally, after passing through and being seized to the eyes on the bucket holder, they meet below the bucket in a shackle which supports an egg-shaped 40-lb. lead.

The rope for closing the net is 2 in. in circumference and 16½ ft. long, with an eye at each end. It passes round the net through the rings on the band *D* and those on the stay wires; its two ends are shackled to a link on the closing mechanism, so that when the messenger releases the "bridle" rods, the net falls away and is caught by it in a noose. The closing mechanism is described on page 192.

As heavy a lead as 40 lb. was used below the net so that it would run out easily under its own weight. To facilitate the handling of the lead when the net comes to the surface a rope is kept attached to it; this is 15 ft. long and has at its upper end a small brass toggle, which can be slipped in and out of a ring on one of the support wires just below the closing band.

A sketch of the net fully rigged is shown in Fig. 9.

The arrangement of the bridle rods, support wires, rings, shackles, etc., has been evolved by the gradual modification in practice of less satisfactory designs. The rigging of such a net had seemed at first a simple matter; the practice, however, of carrying out routine hauls down to depths of 1000 m., often from a heavily rolling ship, showed that many and unexpected defects had to be overcome.

For horizontal use the net is exactly similar except that it has no weight or supporting wires, its bucket is of a simple light pattern (see page 191) and the bridles, instead of being brass rods, are three phosphor-bronze wires, 3 mm. in diameter and 4 ft. in length.

N 100. Designed for the capture of macroplankton, particularly the Euphausians and Amphipods, this net has been used extensively together with the N 70 for routine horizontal and oblique hauls. Only occasionally has it been fished vertically and then its rig was unaltered.

The ring is made of round-section galvanized iron 1 in. thick, has an opening of 1 m. diameter, and has on the outside an eye, of 2 in. diameter opening, as a fair-lead for the closing rope. The three bridles are of 4 mm. phosphor-bronze wire, each 5 ft. in length. The net which is

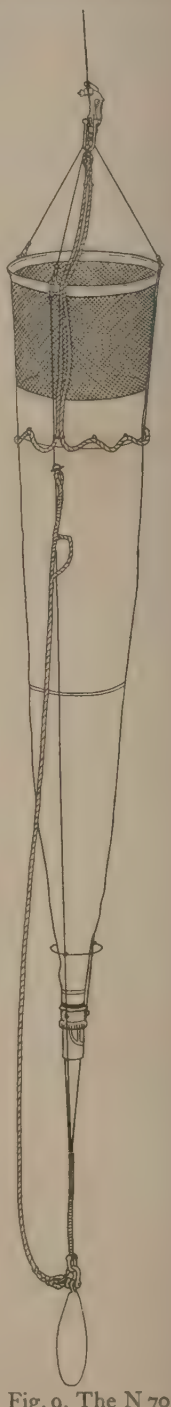


Fig. 9. The N 70 net rigged for vertical use.

lashed to the ring has the cylindrical section *A*, $3\frac{1}{2}$ ft. long, made of $\frac{1}{2}$ in. mesh (knot to knot) netting. The band *D* is of tarpaulin canvas, 6 in. wide, with six galvanized iron rings, 2 in. in diameter, sewn on the outside at equal intervals to take the closing rope. The conical catching part of the net, *BC*, is $10\frac{1}{2}$ ft. long, has a circumference in front of 11 ft. (100 cm. diameter), and tapers to a circumference of 1 ft. 8 in., where it joins a cylindrical section of canvas 1 ft. long for attachment to the bucket. Of the two sections *B* is $3\frac{1}{2}$ ft. long and made of 4 mm. mesh (knot to knot) netting, and *C* is 7 ft. long, made formerly of silk bolting cloth (Staniar's "Quadruple Extra Heavy Quality", No. 16), having 15 meshes to the inch, but replaced later, after July 1927, by stramin. The silk netting with only 16 fine threads to the inch was not strong enough and, even after being supported on the outside by a lacing of stout cord, had continually to be patched or renewed. The stramin is very strong and its threads, although only 11 or 12 to the linear inch, are very coarse, so that the filtration is no more, in fact rather less, than that of the silk netting formerly employed.

Down the length of the net run three 1 in. circumference ropes of log line. These are sewn through long thin strips of canvas to the netting sections *B* and *C*, sewn to the canvas band *D*, and in front threaded through the netting *A* and tied to the ring; behind they have a free end of about 18 in. for tying to the rings of the bucket.

The closing rope is 15 ft. long, and at one end has a large eye through which the other end passes, forming a noose.

The **N 200** net, similar to the N 100 only larger and of wider mesh, is designed to capture the rarer and faster-swimming pelagic forms which might escape the N 100, or to collect, if necessary, such forms as Euphausians in greater quantity than does the N 100. This latter necessity rarely arose since the N 100 usually provided more than sufficient material.

The ring is of galvanized steel, having a stream-line cross section as shown in Fig. 10, and an opening 2 m. in diameter. It was made up from two "half-rounds" and one "flat" riveted together: to those unacquainted with hydrodynamics it is surprising what a great difference there is in the resistance of a towed net with round-section frame and that of one with a stream-line frame. Along the hind margin of the frame are a number of $\frac{1}{4}$ in. holes at 4 in. intervals for lashing on the net. At one point an eye $2\frac{1}{2}$ in. in diameter is attached to the frame, as shown in Fig. 12, as a fair-lead for the closing rope; by this means, when the bridles are released, the frame is held by one edge, and is thus less liable to surge from side to side while being hauled to the surface.

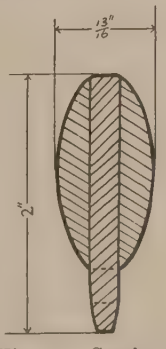


Fig. 10. Section of the stream-line frame for the N 200 net.

The bridles consist of three 2 in. circumference ropes each 12 ft. long. The cylindrical section, *A*, is of 1 in. mesh (knot to knot) netting and is 7 ft. long. The band *D* is of tarpaulin canvas 6 in. wide, with eleven $2\frac{1}{2}$ in. galvanized iron rings sewn on at equal intervals. The catching part of the net *BC* has a total length of $19\frac{1}{2}$ ft., and tapers from

a circumference of 22 ft. to 2 ft. 3 in., where it joins the canvas cylinder, 2 ft. long, for attachment to the bucket. The front section, *B*, 6½ ft. long, is of 7 mm. mesh (knot to knot) netting[1] (Fig. 11 *a*), and *C* is 13 ft. long, of 4 mm. mesh netting[1] (Fig. 11 *b*). As in the N 100 there are three longitudinal ropes, and in addition transverse ropes passing round the net, one between the sections *B* and *C* and one in the middle of *C*. These were originally made of log line to prevent any tendency to twist and so bunch up the net; but it was found not to be strong enough and was replaced by ordinary manila rope of 2 in. circumference. The bucket, like the others, is described on page 191. The closing rope is similar to that of the N 100, but 40 ft. long, 2½ in. in circumference and fitted with a large lignum-vitae bull's-eye.

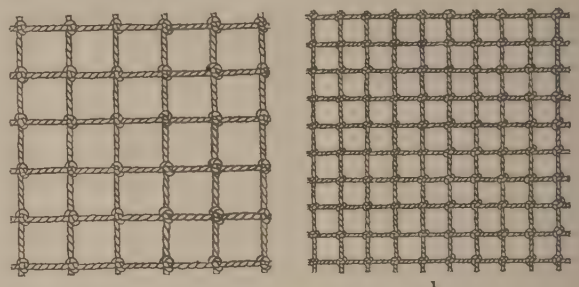


Fig. 11. Fine-meshed netting used in tow-net construction. Nat. size. *a*, 7 mm. mesh; *b*, 4 mm. mesh.

In practice this net was not used a great deal. When the larger, rarer and more active pelagic organisms were required the N 450, next to be described, which has an opening over five times in area that of the N 200, was used whenever possible. For collecting large quantities of the smaller forms the TYF was found to be more efficient.

N 450. This net, with an opening of 4½ m. diameter, is, we believe, the largest tow-net yet fished. Its function, as already indicated, is to capture the larger and more active pelagic animals, particularly the deep-sea forms such as medusae, crustacea, cephalopods and fish. It was feared by some that the difficulties in handling so large a net, especially from a vessel encumbered with much rigging, might prevent its frequent use. These fears, however, proved to be groundless.

That the resistance in towing so large a frame, and one stout enough to retain its shape out of water, should be reduced to a minimum was here a matter of great importance and, as in the N 200, a stream-line section of similar construction was adopted. The details and dimensions are given in Fig. 12. To facilitate stowage the frame was made in four sections to bolt together, and hinges were provided at two joints so that if necessary it could be collapsed into two semi-circular halves for taking inboard. This latter device, however, was found to be unnecessary and was never used. Despite its great strength it was found that, when hoisted into the air by one point, it tended to lose its circular shape; this was prevented by the introduction of a thin steel wire across the diameter of the ring from the point of suspension. As shown in Fig. 12 the bridles,

[1] To find a make of strong and fine netting suitable for these large plankton nets was a matter of considerable difficulty. The two sorts of square-meshed netting shown in Fig. 11, which were also used for fine nets attached to the trawl and for other purposes, were obtained from L. de Séréville, 3 Rue d'Hauteville, Paris X. The 4 mm. netting is supplied in widths of 2 m. 10 cm., and the 7 mm. in widths of 2 m. 50 cm.

four in number, are attached to shackles at the junctions of the four sections. The frames for both these and the N 200 nets were made and galvanized by Messrs F. Braby of Ida Works, Deptford, London.

The four bridles are of galvanized wire rope 6 mm. in diameter, each 20 ft. long. Section *A* is of netting[1] with $1\frac{1}{2}$ in. mesh (knot to knot), $15\frac{1}{2}$ ft. long. The tarpaulin canvas band *D* is 6 in. wide, but should have been considerably wider; it has fifteen 3 in. galvanized iron rings sewn on at equal intervals. The catching part of the net, *BC*, is 45 ft. long, tapering from a circumference of 50 ft. ($4\frac{1}{2}$ m. diameter) to one of 3 ft. at the cod-end, where it joins the canvas cylinder, 3 ft. long, for attachment to the bucket. The netting in section *B* is $\frac{1}{2}$ in. mesh (knot to knot),[1] and that in *C* of 7 mm. (knot to knot) mesh.[2] It was found an improvement to line the "cod-end" of the net with finer 4 mm. material. The longitudinal ropes, four in number, and two transverse ropes were, like those of the N 200, originally made of stout log line, but later were replaced by a soft 2 in. circumference rope of tarred hemp, known in Admiralty dockyards as "Rumbo". Experience showed, however, that any kind of twisted rope is liable to twist still further in use, thus rolling the net up and decreasing its circumference. In consequence all the ropes had to be removed and sewn on again after the turns had been taken out. For roping large plankton nets a flat braided sennet would perhaps be suitable, if log line of sufficient strength cannot be obtained.

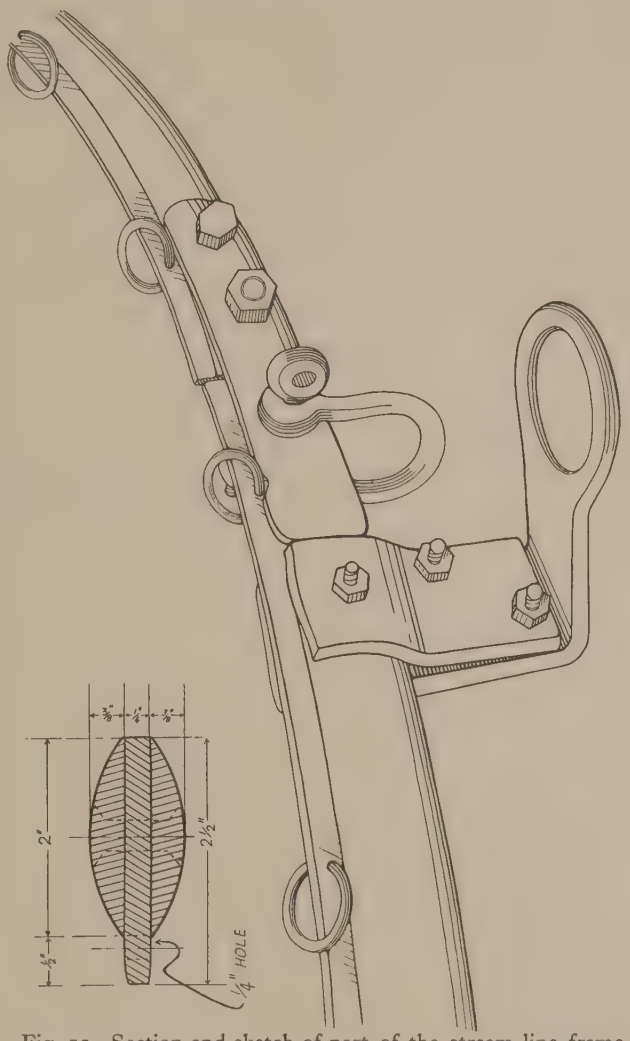


Fig. 12. Section and sketch of part of the stream-line frame for the N 450 net, showing the junction of two quadrants, a towing shackle, rings for the attachment of the net, and the fair-lead for the closing rope.

The specifications of the five types of tow-net are summarised in the table on p. 188.

[1] Made by Messrs Stuart and Jacks of Lowestoft.

[2] Made by L. de Séréville, see footnote to page 186.

TYF. This net is the Petersen young-fish trawl, similar to that modified and described in full by Clark[1] as his type *A*. At first it was used in the normal manner with

	N 50	N 70	N 100	N 200	N 450
Frame					
Diameter	50 cm.	70 cm.	1 m.	2 m.	4½ m.
Section	⅜ in., round	⅜ in., round	1 in., round	Stream-line	Stream-line
Towing bridles					
Material	Bronze	Bronze*	Bronze	Galv. steel	Galv. steel
Diameter	3 mm.	3 mm.	4 mm.	6 mm.	6 mm.
Length	3 ft.	4 ft.	5 ft.	12 ft.	24 ft.
Number	3	3	3	3	4
Cylindrical section *A*†					
Material		Netting	Netting	Netting	Netting
Mesh‡		¼ in.	½ in.	1 in.	1½ in.
Length	26 in.	1 ft. 9 in.	3½ ft.	7 ft.	15½ ft.
Closing band *D*	Canvas				
Material		Canvas	Tarpaulin canvas	Tarpaulin canvas	Tarpaulin canvas
Width		10 in.	12 in.§	18 in.§	24 in.§
Tapering section *B*					
Material		Silk	Netting	Netting	Netting
Mesh‖		40 to linear in.	4 mm.	7 mm.	½ in.
Length	Silk 200 to linear in.	3 ft. 2 in.	3½ ft.	6½ ft.	15 ft.
Tapering section *C*	5 ft. 5 in.				
Material		Silk	Stramin	Netting	Netting
Mesh‖		74 to linear in.	12 to linear in.	4 mm.	7 mm.
Length		4 ft. 5 in.	7 ft.	13 ft.	30 ft.
Section *E* (canvas)					
Circumference ...	8 in.	9 in.	1 ft. 8 in.	2 ft. 3 in.	3 ft.
Length	2½ in.	3 in.	1 ft.	2 ft.	3 ft.
Longitudinal ropes¶					
Material	Bronze	Bronze	Log-line	Manila	"Rumbo" line**
Size	3 mm. diam.	3 mm. diam.	1 in. circum.	2 in. circum.	2 in. circum.
Number	3	3	3	3	4

* Brass rods were substituted when used vertically.
† The letters refer to Fig. 6, p. 181.
‡ Measured from knot to knot.
§ Widths latterly adopted.
‖ Measured from knot to knot unless otherwise stated.
¶ With transverse ropes also in N 200 and N 450.
** A specially flexible rope of tarred hemp.

poles and otter boards as a pelagic trawl, when it had a rectangular opening 6 ft. by 4 ft.; but later, after July 1926, the boards were discarded and the net, mounted upon the N 200 frame, used as an ordinary tow-net. In this form, as used by Russell[2] and

[1] Clark, R. S., *Journ. Marine Biol. Assoc.*, n.s., XII, p. 163, 1920.
[2] Russell, F. S., *ibid.* XIII, no. 4, 1925.

others, it is almost equally efficient, a good deal easier to handle, and can if necessary be closed on the Nansen principle.

It is an excellent net, yielding large catches of macroplankton with a wide range in size. It was used effectively at all depths.

Other Plankton Apparatus

The **Continuous Plankton Recorder**, a new instrument for giving, as the name implies, a continuous record of the plankton through which it has been towed, was tested on many occasions and in all recorded just over 2400 miles of plankton. A preliminary description has already appeared;[1] the full description will be published later in a report dealing with the results obtained by its use. Small plankton indicators[2] were occasionally used to indicate the presence or absence of diatoms or young Euphausians.

Buckets for Vertical Nets. In order to save time on routine stations when a number of vertical hauls are taken—and time in intensive plankton work is a vital factor—special buckets were designed. These are shown in Figs. 13 and 14. They are made of phosphor bronze and consist of two main parts: the holder *a*, a cylinder attached to the canvas end of the net by the band *d*, and the easily detachable bucket *b*, which is screwed tightly up to the holder *a* by the loose collar *c*. The collar is well milled, so that it can be tightly screwed up and quickly undone, and held to the holder *a* by a flange. The inside of the holder which fits into the canvas cod-end of the net is gently bevelled at the top so that no organisms can stick round the edge. The collar *d* grips the canvas where it joins the silk netting immediately round the outside of this edge; a piece of tape or rubber inside this band improves the grip. On the outside of the holder are three eyes *g*, to which are seized the supporting wires to the weight below. The bucket *b* bears a strong screw thread round its upper margin for engagement with the collar *c*. Below this is a series of windows covered with phosphor-bronze gauze: 140 meshes to the inch in the N 70 and 200 meshes to the inch in the N 50. Thus when the net leaves the water and is washed down, the plankton sample is reduced to a reasonable size in that part of the bucket below the windows. It is then unscrewed, replaced by another similar bucket, and is closed by the screw-on lid *f*, so that it may be put down without fear of upsetting, and the work carried on. Each lid bears on the top an oblong strip of ivorine, upon which the depth from which the haul was taken may be written. Opposite the gauze windows the top of the jar is hollowed out on the inside to form a lip for pouring out the sample. The windows of the larger jar are so shaped that they are the maximum size that will allow the sample to be poured out from the opposite side without fouling them: those of the smaller jar are made small and circular on account of the fragile nature of the very fine-meshed gauze. After the sample has been poured out a little water is washed through the windows from the outside and added to the sample, so collecting any

[1] Hardy, A. C., "A New Method of Plankton Research", *Nature*, CXVIII, p. 630, 1926.

[2] Hardy, A. C., *Min. Agric. Fisheries: Fishery Invest.*, ser. ii, VIII, no. 7, 1926.

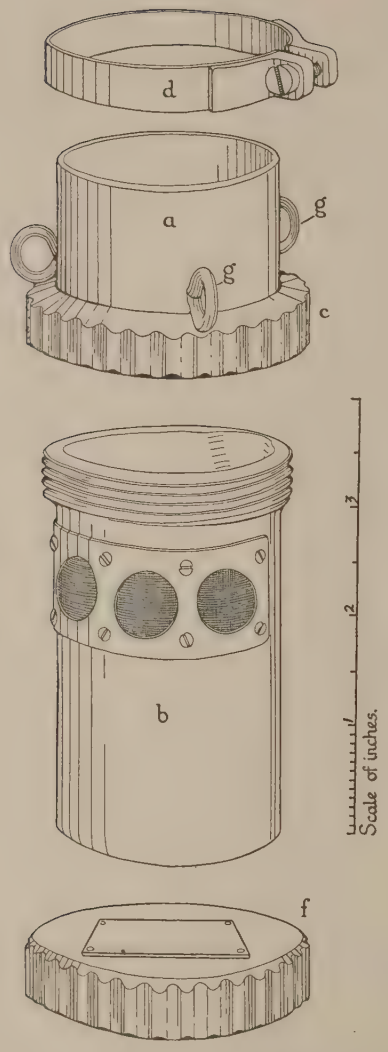


Fig. 13. Bucket, with attachment and lid, for vertical N 50 net: for explanation see text.

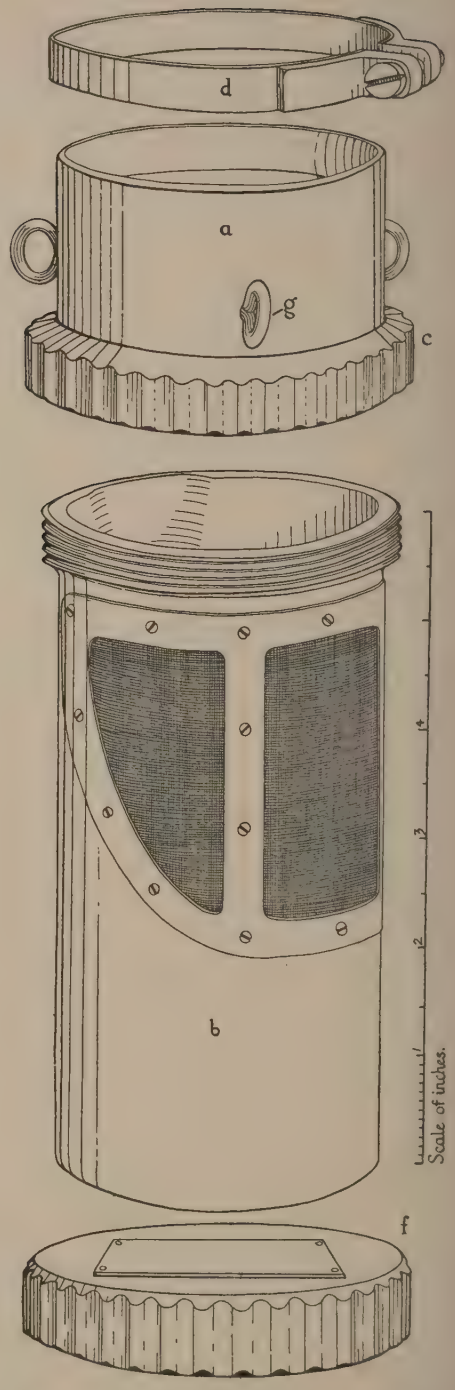


Fig. 14. Bucket, with attachment and lid, for vertical N 70 net: for explanation see text.

organisms which may have remained behind. These buckets were made by Messrs E. R. Watts and Sons.

Buckets for Horizontal Nets. For N 70 horizontal nets simple light cylindrical buckets, made from sheet brass, were used; they were $2\frac{3}{4}$ in. in diameter and 5 in. tall, with a wired strengthening rim round the top. The bucket is slipped inside the canvas cod-end until the rim comes just below the silk netting; here it is tied securely with twine.

The buckets used for the N 100, N 200 and N 450 nets, though differing in size, are all of the same pattern —that shown in Fig. 15. They are made of zinc with a wired edge at the top. Those for the N 100 nets have three rings on the side for the attachment of the longitudinal ropes; in those for the N 200 and N 450 nets the ropes are tied below the bucket. In all three the canvas cod-end is secured by a brass band with a fly nut.

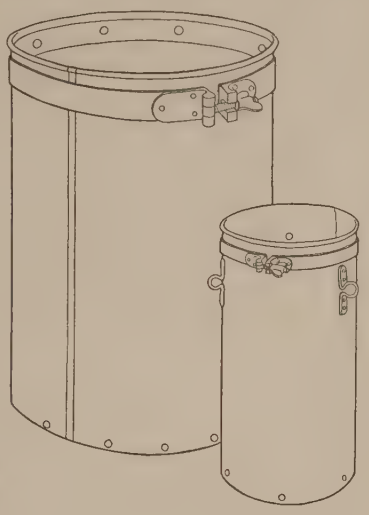


Fig. 15. Buckets for N 450 and N 100 horizontal nets.

The dimensions of the three buckets are as follows:

	N 100	N 200	N 450
Diameter...	6 in.	8 in.	12 in.
Height	12 in.	16 in.	18 in.
Width of band	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{4}$ in.

These buckets and securing bands were found very convenient; but in time the former became distorted by the pressure exerted by the fly nut; to give greater strength a narrow band of galvanized iron was fixed on the inside, just below the rim.

The bucket for the TYF is the standard one made by the Marine Biological Association at Plymouth for this type of net. It is of galvanized iron $7\frac{1}{2}$ in. in diameter and $11\frac{1}{2}$ in. in height, and is fitted with four hinged lugs for attachment to the net, each $4\frac{1}{2}$ in. from the top.

In handling the plankton nets specified above attempts have been made in one or two directions to introduce improved methods. The smaller nets, N 70 and N 100, towed vertically or horizontally and used for routine observations, have with few exceptions been closed before being hauled, and the same procedure has been adopted, though with less success, with the larger nets. Depth gauges of various kinds have, moreover, been employed to determine the level at which horizontal nets were being towed. Before giving an account of the methods of handling the various plankton nets it will be convenient to describe this subsidiary apparatus.

The closing mechanisms used may be divided into three classes: those for vertical nets, those for 1 m. and 70 cm. horizontal nets and those for large horizontal nets.

Closing Mechanisms for Vertical Nets. The apparatus used during most of the commission for the closure of vertical nets is that shown in Fig. 16: in general design it closely resembles that employed by Hjort.[1] In our hands this type was found to give a certain amount of trouble: it was liable to release prematurely and sometimes the wire was found to have come out from the slot in the top lever, and by jamming the

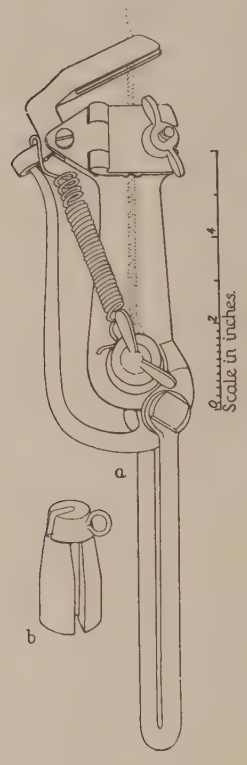


Fig. 16. Closing mechanism for vertical nets: *a*, mechanism; *b*, messenger.

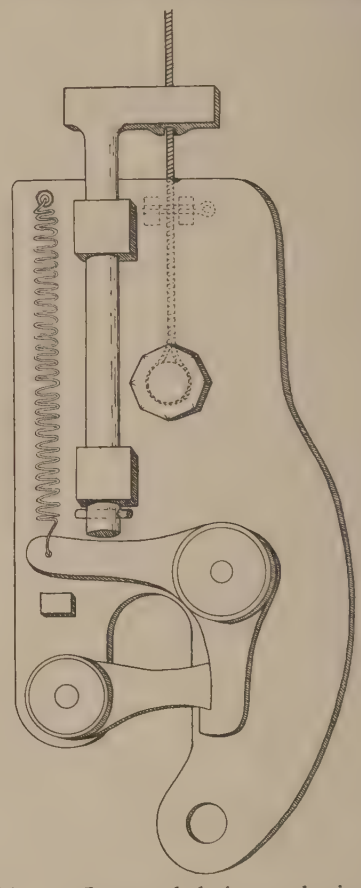


Fig. 17. Improved closing mechanism for vertical nets: ×½.

movement to have prevented release altogether. These difficulties were met by increasing the strength of the spring and by inserting a cotter pin through the ends of the forked lever to keep the wire in its proper place. With these alterations the apparatus worked well in smooth water, but in bad weather, with the ship rolling, premature releases were still liable to occur. If the wire strayed much from the vertical it would bear on the cotter pin and eventually effect release. During the second year of the commission a different pattern of closing mechanism was made by the engine-room staff and this has been found to be a great improvement on the former model, working

[1] Hjort, *Depths of the Ocean*, p. 48, fig. 31, London, 1912.

with certainty under all conditions. This type is illustrated about half size in Fig. 17 and does not call for detailed description.

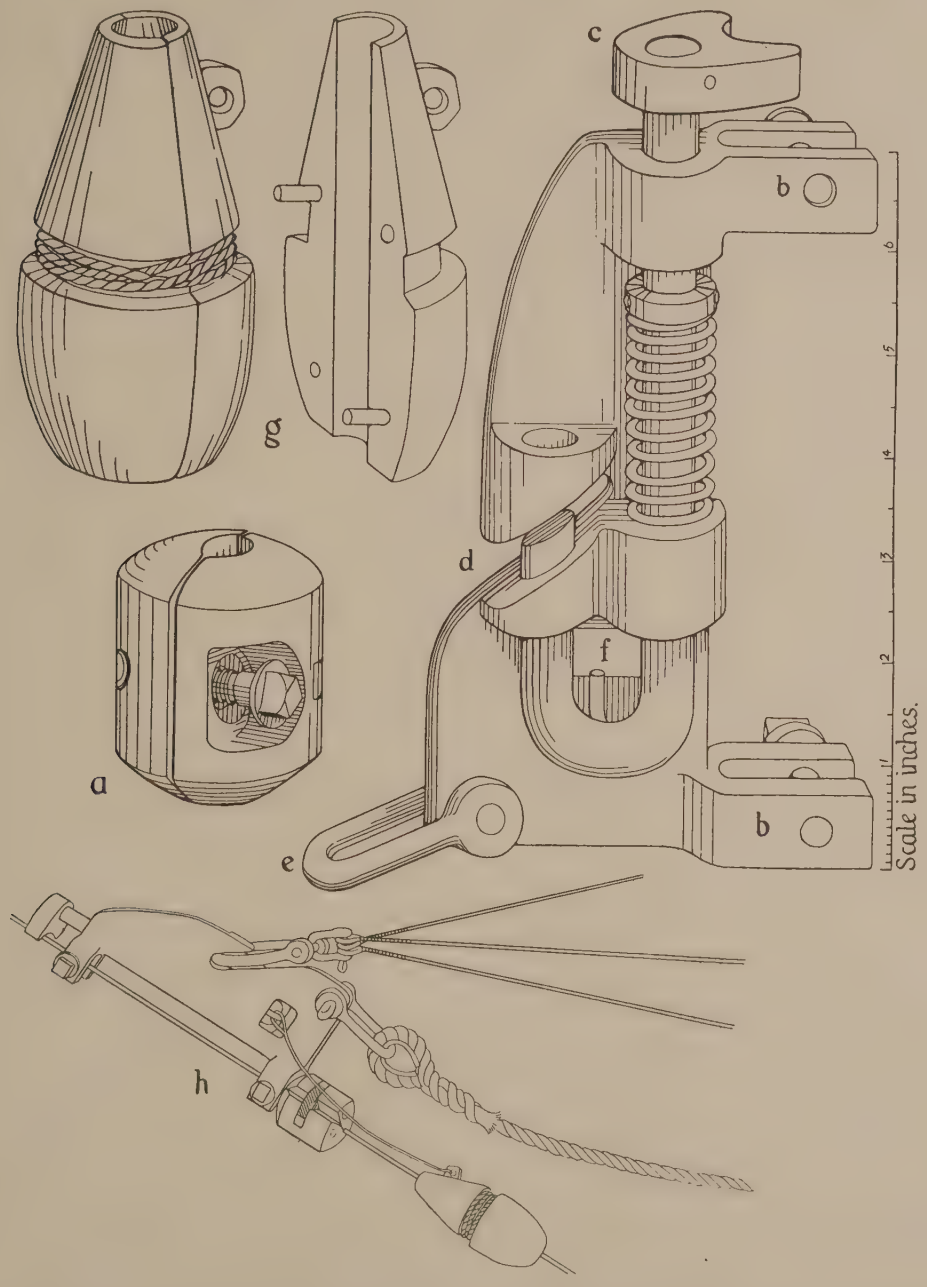


Fig. 18. Closing mechanism for small horizontal nets: for explanation see text.

Two kinds of messenger are ordinarily used with these mechanisms, both of the torpedo pattern described by Knudsen;[1] they weighed 405 and 615 grm. respectively.

[1] Knudsen, *Pub. Circ., Cons. Explor. Mer*, 77, p. 15, fig. 5, 1920.

Closing Mechanism for Small Horizontal Nets. The apparatus shown in Fig. 18 is used for closing 1 m. and 70 cm. nets towed horizontally. In attaching nets to the wire for horizontal work it is essential, as Hjort has pointed out, that the net should be free to revolve on the wire rope; for the rope is continually twisting, and the net, if clamped to it, will become wound round and will not tow properly. The closing mechanism is consequently made to swivel freely on the wire rope, and is supported by a brass screw stop *a* similar to those used by Hjort. The mode of action of the mechanism is evident from the figure. It is attached to the wire rope at the points marked *b* by two screw bolts. The messenger depresses the striking piece *c*, and the link which carries the bridles of the net is slipped from *d*. The throttling rope, by which the net is hauled to the surface, is attached at *e*. It will be noticed that a ring for the release of a messenger to a lower net can be passed through a slot *f* in the base plate and secured by a pin on the moving portion. The second messenger is thus released simultaneously with the closure of the net. In Fig. 18 *h* the apparatus is shown assembled on the wire rope, with a messenger for the release of a lower net.

This type of release gear has proved very satisfactory, but the heavy messengers that were used tend to bend or break the cast brass fork of the moving portion. Repairs were easily effected, but it would perhaps be better if this movable part were made of steel. The messengers (*g*) were of a very simple type, stream-line in form, 3 lb. in weight, and made in two halves seized together with a piece of twine. A still heavier messenger, that shown in Fig. 19 *m*, was also sometimes used with this apparatus. Both messengers took approximately half a minute to travel 100 m., the time varying somewhat with the angle of the warp. In serial work it was found best to attach the messenger for the lower net to the release of the upper by means of a length of stiff galvanized wire, rather than by cod-line and a ring: by this method all chance of the line fouling the stop was prevented.

Opening and Closing Mechanism for Large Horizontal Nets. The apparatus used with large nets is more elaborate and is shown in Figs. 19 and 20. Like the smaller mechanism described above, it is designed to swivel on the warp, to which it is attached by means of the two sliding clamps *a* and *b*. The primary release is at *c* and is opened by a small messenger striking the forked lever *d*. At the same time another small messenger for despatch to a lower net can be released from the catch *e*. The secondary release is at *f*. This link takes the whole towing weight of the net, and since it was anticipated that if the messenger acted directly (as with the primary release) the friction would be so great as to prevent movement, a double action was fitted by inserting the tumbler block *g*, the whole being arranged to give a leverage greatly in favour of the messenger. The rods effecting this release are attached above to the semi-circular striking piece *h*, which must of course be large and wide enough to permit free passage to the primary messenger; at the lower end they actuate another catch, by which the secondary messenger can be slipped to a net attached lower down the warp. We found in practice that with a net towing from the link *f* the apparatus was canted out

of the straight line, and in order that the messenger may meet the striking piece *h* fairly, the latter is set at an angle of 20° to the horizontal. The apparatus is supported

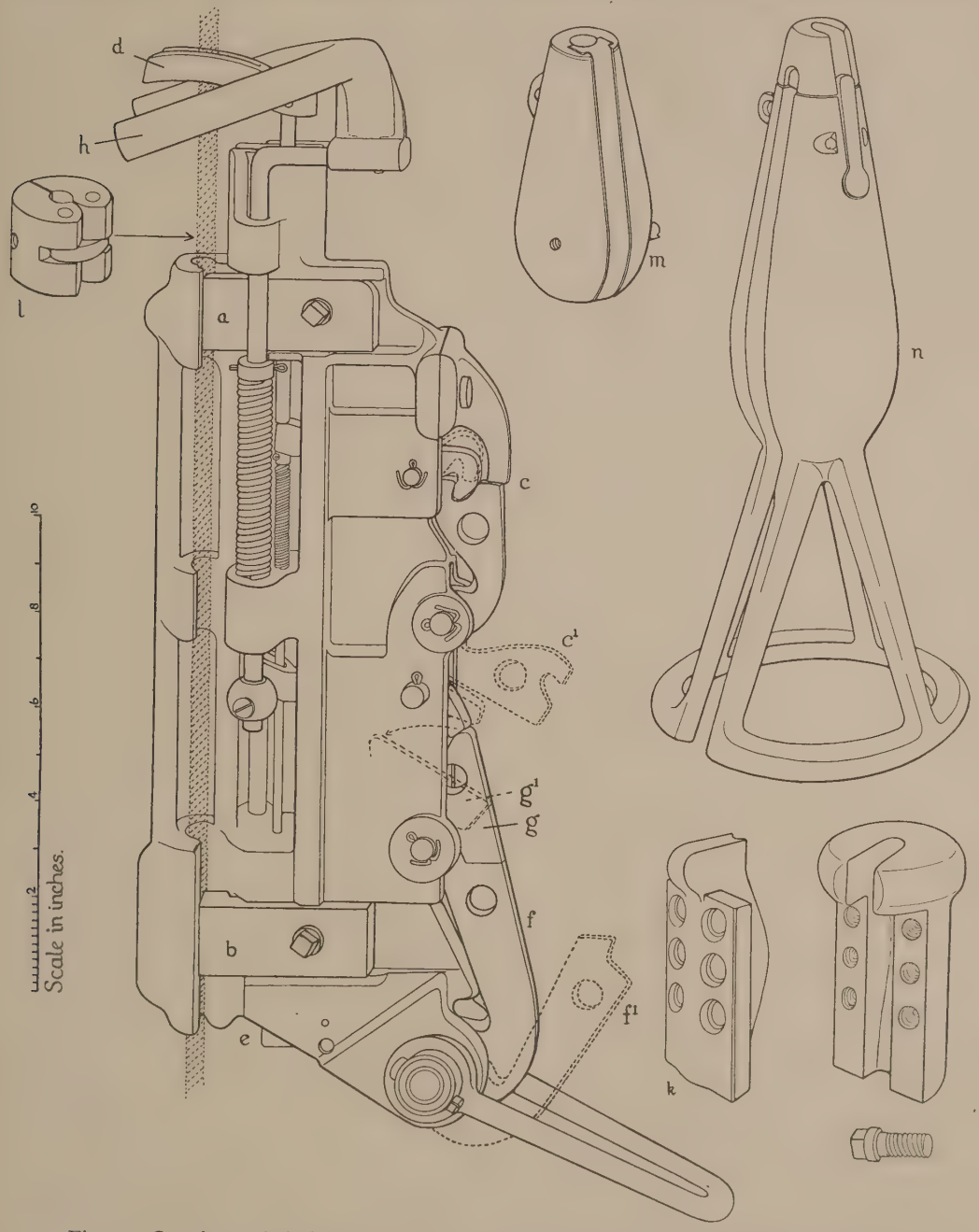


Fig. 19. Opening and closing mechanism for large horizontal nets: for explanation see text.

on the stop shown at *k*, which is attached to the warp by six bolts, and, with a view to obtaining a better grip, it is so made that it causes a slight bend in the warp. This stop

proved unsatisfactory. It frequently slipped and it is almost certain that a simpler pattern, with two screws at most, would prove more efficient.

If a large net is lowered rapidly there is a tendency for both net and closing mechanism to slide up the warp, and if this happens the lines by which the messengers for the lower net are attached will break: it is also very likely that when the apparatus slides back to the stop the momentum consequent upon the impact will be sufficient to effect release. This possibility was foreseen when the apparatus was designed, and room is made for the insertion of a small stop *l* at the upper end to prevent any movement in an upward direction. The primary messenger is shown at *m* and the secondary

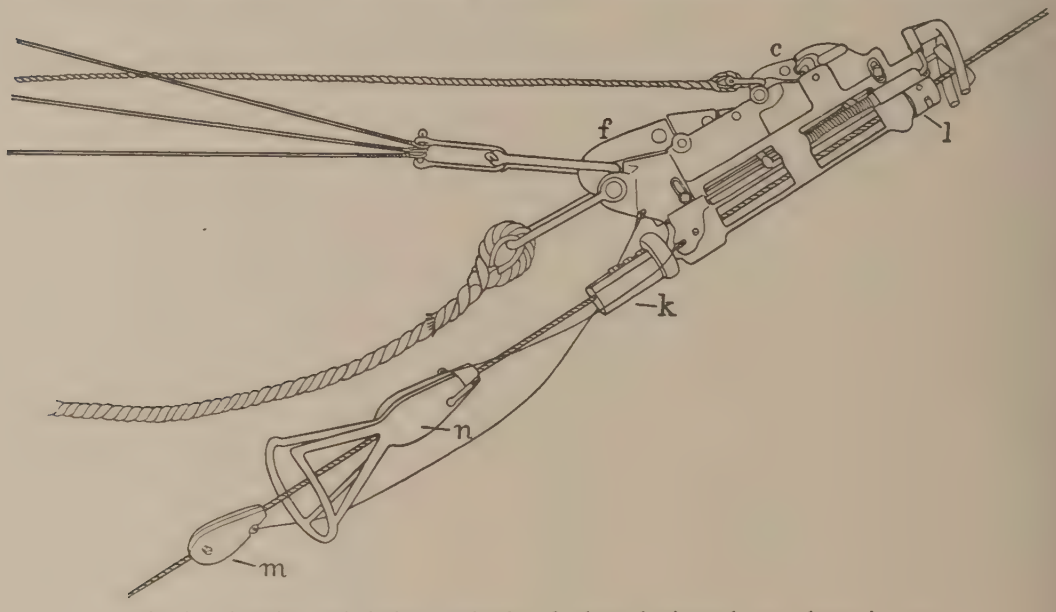


Fig. 20. Opening and closing mechanism for large horizontal nets, shown in use.

at *n*: the former is $5\frac{1}{2}$ lb. in weight and stream-lined in form, the latter is 22 lb. in weight and apart from the conical extension piece is similar in shape. The smaller messenger travels at a rate of $3\frac{1}{2}$–$4\frac{1}{2}$ min. and the larger at about 4–5 min. per 1000 m., the speed depending largely on the angle of the warp. The entire apparatus is made of phosphor bronze except for certain pins, at points where exceptional strength is required, which are of steel.

Apart from the defects shown in the stop this apparatus proved all that could be desired, but as is explained further on, the results obtained with these large horizontal nets were not always satisfactory.

Depth Gauges. To determine with any accuracy the depth at which mid-water nets are being towed is a matter of some difficulty. In most deep-water investigations the data on this point appear to be based mainly on guess-work, and in a recent expedition all attempts to determine the level are abandoned, and the only information given regarding

depth is the number of metres of wire rope paid out. The depth at which a towed net is working is governed by a considerable number of factors, the most important being the length and size of the rope, the size and pattern of net, the weight of the lead and the speed of the ship, and since there must nearly always be some variation in one or more of these particulars it is hardly possible, even with the most carefully standardized system of hauls, to work out a table of calibration. The only reliable method is to use a depth-gauge with each haul, and unfortunately no perfect instrument for deep-water work has yet been invented.

In the 'Discovery' investigations a number of different types of gauge have been used: (i) the Admiralty pattern, recently employed with such good results by Mr F. S. Russell in his studies of vertical movements of plankton in the English Channel; (ii) the Kelvin tube, commonly used by seamen to determine shallow soundings from a moving ship; (iii) the Budenberg gauge, made by Schaffer and Budenberg and formerly used by the Prince of Monaco; and (iv) a pattern in which the depth is determined by the difference in the readings of protected and unprotected reversing thermometers. In addition a new pattern of gauge was tried, but proved unsatisfactory. The vibration of the warp caused the index to shift and the readings were unreliable.

It was unfortunately only possible to use the Admiralty pattern gauge to a very limited extent, for though it gives excellent results, it cannot be employed below depths of about 50 fathoms. With most of the shallow horizontal nets a Kelvin tube was used, inserted in a brass case lashed to the shaft of the stream-line lead. By this means a depth for the lower net is obtained without difficulty, but the method is, of course, open to the objection that only a single reading is taken and that the level at which the net is fishing may alter while it is being towed. The Kelvin tube was occasionally used to depths of 100 fathoms, but the scale above 75 fathoms becomes very small and cannot be read with any accuracy.

For work in deeper water the Budenberg gauge[1] was used on many occasions. The instrument is large and very heavy, and was attached to the end of the warp either with or without a stream-line lead. It works on the Bourdon principle, and gives a graph which can be read with reasonable accuracy to about 25 m.; but since its limit of depth is 1500 m., it can only be employed in the upper layers of the water. In certain series of hauls, when five nets were being towed simultaneously, this gauge was used at the bottom in conjunction with a Kelvin tube on the second net from the surface. The Budenberg gauge gave excellent results, but it has one serious defect which detracts greatly from its usefulness. The instrument is lenticular in shape, made in two halves with a large circular washer as a joint, and is held together by twelve steel bolts, all of which must be removed in order to open it. In practice it was found almost impossible to make the joint watertight. No matter what means were tried a small leakage occurred, and this, though insufficient to have any appreciable effect on the reading, made it necessary to dismantle the entire mechanism and clean it thoroughly

[1] Described in *Forschungsreise S.M.S. 'Planets'*, 1906–7, CXI, *Ozeanographie*, Berlin, p. 11, 1909.

after each operation. Parts of the clock-work were of steel and would rapidly have been destroyed if continual care had not been taken.

For depths below 1500 m. the only gauge used was of the reversing thermometer type[1]. If carefully calibrated beforehand a pair of thermometers, one protected against pressure and the other unprotected, will give a more reliable indication of depth than can be obtained by any other means. The thermometers were made by Richter and Wiese of Berlin, and were used at first in simple reversing frames supplied by the makers. These frames, though doubtless strong enough for vertical work, proved to

Fig. 21. 56-lb. stream-line lead, with bar attached.

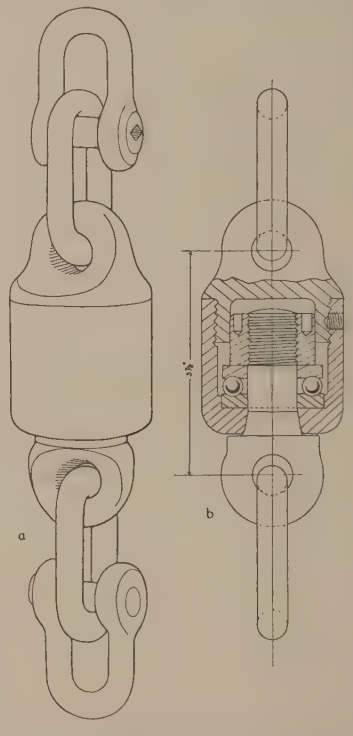


Fig. 22. Ball-bearing swivel for use with trawls, dredges and large tow-nets.

be too frail for our purpose and others of heavy cast gunmetal were substituted. These proved satisfactory, but later were replaced by an ordinary Ekman reversing bottle adapted to fit on wires of large calibre. The bottle serves equally well and has the added advantage that it provides a water sample as well as the temperature. In placing such instruments as these on a long length of towed wire rope, a stop should be used and the instrument attached above it with a loose-fitting clamp, so that it will not revolve as the rope twists and untwists. The thermometer type of gauge will, of course, only record the depth at the moment when the messenger arrives, and for biological work it

[1] For description of the method see Ruppin, *Wiss. Meeresuntersuch. Kiel, Helgoland, Abt. Kiel*, neue Folge, IX, p. 182, 1906, and Brennecke, *Ann. Hydrographie*, 41, p. 363, 1913, and 42, p. 34, 1914.

is thus less suitable than an instrument which provides a graph. In practice the reading of the gauge was taken as the mean depth, and an estimate of the levels in which the net was towing was arrived at by making an allowance (usually of about 50 m.) above and below the reading.

For all horizontal nets **Stream-line Leads**, as shown in Fig. 21, were used. These leads are an improvement on the ordinary pattern, offering less resistance to the water and giving a greater effect for the weight employed. Each lead is 56 lb. in weight, and the bar, which is 3 ft. long and also stream-lined in section, is bored with a series of holes so that any number of leads, up to four, can be attached to it.

In using stream-line leads and with every type of net **Swivels** are necessary. For the leads and light mid-water nets a simple galvanized swivel answers well enough, but with trawls, dredges and large plankton nets something better is required. For such purposes the ball-bearing pattern shown in Fig. 22 was used—made by Thos. and Wm. Smith, Ltd. These swivels with their links are tested to $2\frac{1}{2}$ tons; they are compact and pass easily through the fair-leads, and in every way proved most satisfactory.

Methods of Handling Plankton Nets

The engines, reels, wire ropes, nets and fittings used in plankton work on board the 'Discovery' and 'William Scoresby' have now been described and figured. It remains to describe the method of working.

Vertical Nets. On ordinary routine stations one haul is made with the N 50 net from 100 m. to the surface, and a series of hauls with the N 70 net, soundings permitting, as follows: 50 m. to the surface, 100 to 50, 250 to 100, 500 to 250, 750 to 500 and 1000 to 750. When possible deeper hauls were taken from 1500 to 1000, 2000 to 1500, 2500 to 2000 or 3000 to 2500.

In the 'Discovery' three persons are required to work the plankton unit efficiently: two scientific officers and a deck hand. Of the two officers one is on the outboard platform to adjust the closing mechanism and net before descent, to despatch messengers and to wash down and take the sample at the end of the haul; the other, who is in charge of operations, is inboard to control the engine, the depth reached and speed of winding, and to time the despatch of the messenger. In the 'William Scoresby' outboard platforms were not necessary and only one scientific officer was required. The deck hand guides the wire on the drum, pulls up the weight and holds the net for washing down.

After an examination, when the closing rope is seen to be open to the full extent, the net is lowered to the surface and the hands on the dials of the recording sheave adjusted to zero. This being done, the net is lowered to the depth from which the haul is to be taken. When the ship is rolling heavily—a not infrequent occurrence in the vicinity of South Georgia—the wire must be let out with great care. As the ship

rolls to starboard, that is, away from the side of operation, the wire must be allowed to run out easily; as it rolls to port the drum must be checked by the brake or the wire may become slack, over-ride a sheave and possibly kink. The danger of this happening becomes less the further the net goes out, because the strain on the wire is increasing with its own increasing weight; in hauling in the strain completely removes the danger. It has already been explained in a previous section (page 166) that modifications were made to the apparatus to prevent the wire from over-riding the sheaves when being paid out, and that the spring accumulators were of considerable assistance in mitigating this nuisance. But when all possible improvements had been made, the danger of kinking still existed and great care was always necessary in paying out the wire. If a hitch occurred the strain outboard was taken up by means of the brass clamp shown in Fig. 26.

Reference has already been made, on page 183, to the defects in the original design of the net which caused failure of operation. The fouling of the closing mechanism by the wire bridles or throttling rope was most likely to occur when the net was allowed to run out too fast. Even now that these difficulties have been overcome, and under favourable conditions of sea, a limit should be set to the speed of descent; for at great depths the wire by its increased total weight may fall faster than the net itself if allowed to run out at full speed. This, with the rolling of the ship, was another cause for premature releases with the old type of gear (see page 192).

As soon as the net reaches the required depth, the drum is stopped and put into gear, and the messenger, unless a haul to the surface is being made, is attached to the wire and held by a piece of line until the moment for despatch. The net is wound up at the speed of 1 m. per second. An even and exact rate of winding may be maintained, after a very little practice, by regulating the steam valve whilst watching the metre-recording sheave in conjunction with a stop watch. The times that the particular messenger in use takes to fall to the different depths required has been calculated from previous trials. Thus when the haul is (say) from 750 to 500 m., the messenger, which is known to fall 500 m. in 160 sec., is released from the surface when the metre wheel records that the net, in its upward passage, has reached 660 m. The upward haul is continued without a break, so that the net meets the messenger at 500 m. and is closed. After this the net, no longer fishing and offering less resistance, may be hauled more quickly, but never more than 4 or 5 m. per second if damage to the net is to be avoided. In the haul from 1000 to 750 m. the messenger, which takes 240 sec. to fall 750 m., must be released when the dial reads 990: i.e. 10 sec. after the haul is started. At greater depths it may be necessary to release the messenger and wait before starting the haul: thus from 3000 to 2500 m. one must wait 5 min. A table of dial readings and times is easily drawn up for any particular type of messenger. Careful winding should ensure accuracy of release to within 1 or 2 m. in the shallower hauls and not more than 10 m. in the 1000–750 m. haul. When the ship is drifting before a wind so that the wire is off the vertical a slightly longer time must be allowed for the falling of the messenger. It has already been explained (p. 166) that the spring accumulators

afford a means of checking the accuracy of the haul, for they indicate by their sudden extension the exact moment when the closure of the net is effected.

On reaching the surface the weight is pulled up by its special rope and the net washed down on each side with water from a bucket. The brass net bucket is now detached, replaced by another, the net fully opened and the mechanism reset for the next descent.

When all is working properly the routine of N 50 and the six N 70 hauls takes 2 hours to complete.

Routine Horizontal Nets. On arrival at South Georgia it was necessary in the first place to find a method by which comparable hauls of *Euphausia superba* (whale-food) and associated organisms could be obtained. This Euphausian, which is the largest in the group to which it belongs, swims actively, and we soon discovered that it could not be caught in nets hauled vertically. It can escape even the N 200 hauled as quickly as possible, and though a vertical N 450 proved more successful, this net was too difficult to manipulate. Experience showed, however, that very good catches could be obtained in horizontal nets. Towed N 100 often yielded thousands of the species and it was frequently taken in abundance in the N 70. Horizontal N 100 and N 70 were therefore adopted as a routine method of investigation; they were used open at the surface and with a closing mechanism working on the Nansen principle at depths of about 60 and 120 m. At first both the N 100 and the N 70 were shot together and towed for 1 mile at a speed of 2 knots; but it was found that unduly large catches were then made in the finer net and subsequently the two sizes were towed separately, the N 100 for 1 mile and the N 70 for $\frac{1}{4}$ mile. The method proved very satisfactory: closure of the nets could be effected with reasonable certainty and none of the difficulties referred to below in connection with the larger nets was experienced. So far as can be ascertained the catch is not appreciably diminished if the net is closed, and the material was always in first-rate condition, with the majority of the organisms still alive. With nets worked on this principle hundreds of hauls have been made, both in the whaling areas of South Georgia and the South Shetlands and in other parts of the South Atlantic. During some special investigations off the African coast repeated hauls were made with a surface net and four closing nets used in series on the same wire rope, the total length of rope being 400 m.

One objection to the use of these flights of horizontal nets is that a patch of plankton may occur at a level which lies between those at which the nets are fishing. *Euphausia superba* lives in swarms or patches which are sometimes very strictly localized horizontally, and on more than one occasion the fore part of one of the nets (in front of the throttling rope) came to the surface covered with Euphausians, though few or none at all were found in the bucket. In June 1927 experiments were made with oblique hauls and these proved so satisfactory that in routine work they have been substituted for the horizontal hauls. It is thought that they give a better indication of the total plankton which is present, and for economic purposes this is a more important consideration than information, which the horizontal nets might yield, on the vertical distribution

of the various species. For oblique hauls open N 100 and N 70 were attached to the warp close together and 3 or 4 m. above the lead. With the ship steaming at 2 knots 200 m. was paid away, and as soon as this had been done hauling commenced. The rate of hauling was 10 m. per minute; each haul thus took 20 min. and the distance covered was two-thirds of a mile.

In working **Large Horizontal Nets** attempts were made to effect some improvement in methods. As a general rule large horizontal nets are fished open and no matter how long they may have been towed at a particular level many organisms must necessarily be caught during the ascent of the net. As a result it is only by a careful comparative study of a large number of hauls that any good estimate can be formed of the horizons at which an abundant species lives, while with scarcer forms the data are nearly always insufficient. If the larger and more active planktonic animals are to be secured, a net of large dimensions is a necessity, and it appeared important to find out some method by which these large nets could be closed.

Originally it was hoped that it might be possible to send nets down closed, to open them when the full amount of warp had been paid out, and to close them again before hauling. In the arrangement suggested a number of rings were sewn to a canvas band some distance from the mouth and on the *inside* of the net. A short running line was passed through these rings and the whole fore part of the net drawn through the frame. The fore part thus took the form of a cone inside the bridles, and the running line at the apex of the cone was linked to the primary release of a mechanism attached to the wire rope (a description of this mechanism will be found on p. 194). The after part of the net tailed out in collapsed form from the inner apex of the cone, the bucket itself extending well behind the frame. When, by despatch of the first messenger, the running line was released, the net would be carried by the weight of water through the frame and would take up its normal form. To close the net when the haul was completed the Nansen method was employed. A link carrying the bridles was slipped from the secondary release, and the net was closed and hauled to the surface by a running line passing through another series of rings on the outer side of the canvas band and through a fair-lead on the frame of the net.

Experiments carried out on these lines resulted, in part at least, in failure. To shoot a large net, closed as described above, proved a matter of very great difficulty, due partly to the inherent inconvenience of the arrangement, and partly to the limited deck space and to the obstruction caused by the mizen rigging. Although on one or two occasions the N 450 has been successfully opened and closed by this method, the operation was far too awkward for routine work and the idea of shooting large nets closed was abandoned. This is perhaps not a matter of vital importance; for if horizontal nets are shot at a fair speed they catch practically nothing during the process, as has been shown by closing them immediately after they have been let out. To close the net before hauling is a much more important consideration: in this manœuvre greater success was attained, and with experience in manipulation it was

found that large horizontal nets can be closed with a reasonable degree of certainty. But though almost all difficulties in the actual operation were overcome, the results fell much below expectation. Frequently the catch was disappointingly small and on a number of occasions the condition of the material left much to be desired. Throughout these hauls with large nets a speed of about 2 knots was maintained, and it is possible that the smallness of the catch when a net is closed indicates that an unexpectedly large proportion of the material obtained in an open net is caught on the way up, when the speed through the water is augmented by hauling. The poor condition of the material in some hauls is probably to be attributed to the surging movement of the net while being drawn to the surface. When a large horizontal net is hauled from deep water after having been closed on the Nansen principle, it appears sometimes to behave like an ill-constructed kite, the bucket lashing from side to side and causing serious damage to the contents. If the fair-lead on the edge of the frame is omitted the trouble is aggravated. On one occasion it was found, when the net had been hauled, that this fair-lead had carried away, and the condition of the material was far worse than anything previously seen. Except for the most heavily constructed organisms practically everything was destroyed: even the limbs of the larger Crustacea were broken up into their component segments.

In spite of these disadvantages a large amount of material has been obtained in good condition and with accurate data of the horizon at which it was caught, and this, though less in quantity than that obtained in large open nets, should prove of considerable biological interest. It is hoped in the future to conduct further experiments, with a view to finding some method of closing large midwater nets which obviates the disadvantages referred to above.

The N 450 was usually carried with the frame outboard, just abaft the mizen rigging. When shooting, the bucket and net were put overboard and the lashings were cast off, leaving the net suspended only from a slip-hook on the masthead tackle. When the frame had been lowered sufficiently the slip-hook was tripped. In hauling, the net was brought directly to its proper position on the port quarter, where it remained until it was next required. The N 200 and TYF could of course be handled very easily and no description of the procedure in shooting and hauling is necessary.

When these large tow-nets were fished open, the net was shackled to a ball-bearing swivel at the end of the wire rope, and a length of stray line, attached *behind* this swivel, was used to carry the weight. The swivel is an important part of the equipment. When any considerable length of rope is paid out, it is continually twisting and untwisting, and unless a swivel is used, the stray line and weight will become foul of the net and prevent it from fishing. Other nets can be employed at any desired point by fixing a stop on the wire and attaching the net above this point by a shackle in the manner recommended by Hjort (*Depths of the Ocean*, p. 49).

When the net was to be closed, the weight was attached directly to a swivel at the end of the wire rope and 20 or 30 m. paid out. The stop and large mechanism were now attached to the rope just inside the fair-lead on the after rail, and when a final

inspection of bridles and throttling line had shown that all were clear and properly adjusted, a snatchblock was placed on the rope in front of the gear and the rope hauled up until the apparatus could pass clear of the fair-lead. The net was now put out, the frame lowered and tripped, and as soon as all was clear and well away the rope was slackened back into the fair-lead. On some occasions a second net and mechanism were added at an intermediate point on the wire, with messengers slung below the stop to operate the release of the lower net. It is no doubt possible to shoot a whole series of closing nets on the one warp, and, as explained above, this has been managed very successfully with small nets worked at shallow depths.

TRAWLS, DREDGES AND OTHER APPARATUS

The scientific programme for the 'Discovery' did not include trawling and dredging at great depths, and work on the bottom was for the most part limited to areas in the south where the depth did not exceed 600 m. Plankton and hydrography were, moreover, the subjects with which this vessel was more particularly concerned and investigation of the bottom fauna was only undertaken at irregular intervals. As has already been explained, a trawling survey of the grounds lying between the Falkland Islands and the South American coast formed part of the work of the 'William Scoresby'.

Trawls. The trawl in the 'William Scoresby' has a headline 80 ft. long and is made to the specification shown in Fig. 23: it was used with otter-boards 10 ft. long and 4 ft. 4 in.

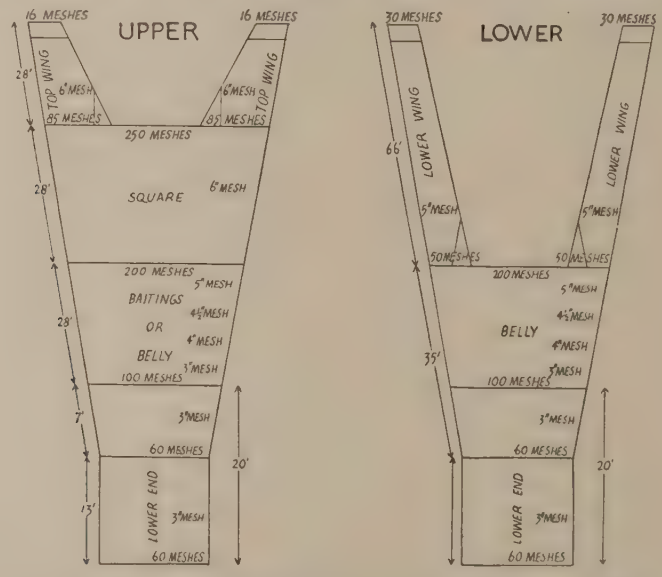


Fig. 23. Plan of otter trawl used in the R.S.S. 'William Scoresby'.

high, fitted with brackets. The trawl used in the 'Discovery' was a small one, with head-rope 40 ft. in length, made to the specification shown in Fig. 24; the otter-boards were 5 ft. long and 2 ft. 11 in. high, fitted with chains.

In the 'William Scoresby' the trawl was towed from two wire ropes in the manner usual in commercial vessels. In the 'Discovery', bridles, 25 fathoms in length, were used in conjunction with a single wire rope; in connecting them a ball-bearing swivel of the pattern shown in Fig. 22 (p. 198) was always used. In the south, and especially in the Palmer Archipelago, trawling is attended with some risk, for the bottom is frequently strewn with large stones and boulders, presumably ice-borne, which are very liable to damage the gear.

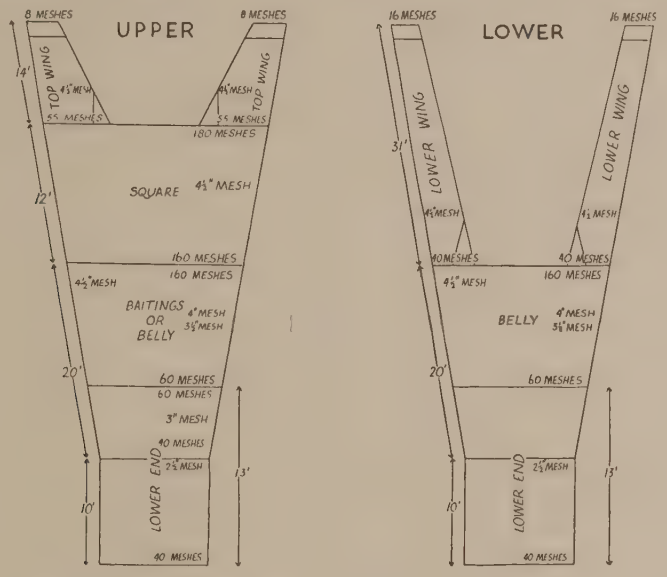


Fig. 24. Plan of otter trawl used in the R.R.S. 'Discovery'.

The trawls, which were made by the Gourock Ropework Company, proved very satisfactory and their catching power was greatly augmented by the addition of fine-meshed bags attached to the back. On several occasions when the cod-end of the trawl was so badly torn that it retained practically nothing, quantities of valuable material were taken in these fine nets and almost always they yielded large supplies of small

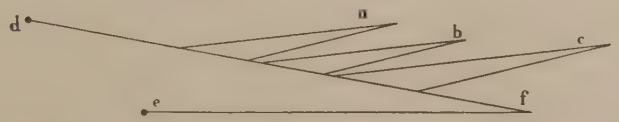


Fig. 25. Diagram of trawl, showing positions of fine-meshed nets: *a*, net of coarse silk; *b*, net of 4 mm. mesh; *c*, net of 7 mm. mesh; *d*, head-rope; *e*, foot-rope; *f*, cod-end.

organisms, particularly of Crustacea, which would inevitably have escaped through the meshes of the main net. Three sizes of fine-meshed net were used on the trawl, one made of coarse silk with 16 meshes to the inch, one of 4 mm. and one of 7 mm. mesh, and these were stitched to the baitings and lower end in the positions shown in Fig. 25. As the foot-rope passes over the bottom it disturbs small organisms, which are carried by the swirl of the water through the meshes of the back. The smaller and lighter

organisms tend to be lifted most and consequently the silk net is placed in front and the 7 mm. net nearest the cod-end. The precise positions for obtaining the best results are easily found by experiment. It will be noticed that the nets must be specially shaped, with the upper side longer than the lower, so that they may stream out properly when the net is fishing. For the silk net an old tow-net may be used with the fore part cut away obliquely at an angle of about 40°. This system of attaching fine nets to a trawl was apparently first advocated by the late Dr E. W. L. Holt[1] and deserves to be more widely adopted. It can be employed equally well with beam trawls, but is of course impossible with an Agassiz trawl, which is fitted with two foot-ropes and is designed to fish either way up. Since Hjort has shown that a 40 ft. otter trawl can be worked successfully even in mid-ocean, little can be said in favour of the Agassiz pattern, and the impossibility of attaching fine nets is a very serious objection to its use.

On board the 'William Scoresby' the procedure in shooting the trawl is the same as that used on commercial vessels and does not require description. In the 'Discovery' the trawl was shot first of all from the port side of the ship, where, by swinging one of the life-boats on special davits, a length of clear rail had been provided between the main and mizen rigging. This position was, however, inconvenient and it was found better to shoot the net over the stern, with one board hanging on each quarter. If, when using the warp on the port side, the starboard board was slipped a few seconds later than the other, the trawl could always be shot clear.

A 30 ft. beam trawl was carried in the 'Discovery' in addition to the otter trawl, but the latter proved to work so well that it was not used. One of the 30 ft. nets was, however, adapted for use with otter boards and was employed on a few occasions. Small beam trawls, with beam 8 ft. in length and with $\frac{1}{2}$ in. mesh (knot to knot) at the cod-end, were carried on both vessels and were used mainly from boats in shallow water, generally with a coarse silk net attached to the back.

Rectangular Nets consist merely of a rectangular frame with a long bag of netting, towed by four bridles: for all practical purposes they are identical with what is usually called the D-net. Three sizes were taken: (i) with frame 8 ft. by $2\frac{1}{4}$ ft. with bag of $\frac{1}{2}$ in. mesh, (ii) with frame 4 ft. by $1\frac{1}{4}$ ft. with bag of 7 mm. mesh, and (iii) with frame 3 ft. by 1 ft. with bag of 4 mm. mesh. In the first of these the frame was made of flat steel, 2 in. broad and $\frac{1}{2}$ in. thick, with a series of holes along one edge for the attachment of the net. In the other sizes the frame was of $\frac{7}{16}$ in. round galvanized steel, which proved rather weak for the larger of the two. In these frames the ends were not welded, but were connected by means of an eye on the one part and a screw thread and nut on the other. The nets were attached to galvanized rings threaded on the frames. The two larger sizes were used from the 'Discovery' and coarse silk nets were sometimes attached to them: the smallest was for work from boats. Nets of these types are efficient on suitable ground, but were not used on many occasions.

[1] See Calman, *Fisheries, Ireland, Sci. Invest.*, 1904, 1, p. 4 (1905).

Dredges. Two kinds of naturalists' dredge were used, both supplied by the Marine Biological Association and both of the double-sworded type. In working them the usual procedure was adopted: one arm only was shackled to the warp and the other was seized to it with several turns of trawl twine. If the dredge hitches, the seizing parts, and by this means the chances of loss or damage are lessened. Both dredges are galvanized, 4 ft. in length, 1 ft. in breadth, with arms $4\frac{1}{2}$ ft. long, and the only difference between them is that one is of much heavier material than the other. The lighter pattern proved much too weak for the very rough bottoms which were met and after one or two trials its use was discontinued. In the heavier type the frame is 3 in. wide and bevelled from $\frac{3}{4}$ to $1\frac{1}{4}$ in. in thickness; the double bars which form the arms are each $\frac{3}{4}$ in. in diameter. The weight is about 140 lb. For work in the south dredges of exceptional strength are required; bags, even of the heaviest netting, with plenty of chafing material attached to the outside, were not infrequently torn away, and we believe that they might more suitably be made of steel link.

The conical dredge, with mouth 18 in. in diameter and a canvas bag, is designed to bring up large samples of the bottom and for this purpose is a most efficient instrument. Its use was adopted as a routine in the trawling survey made by the 'William Scoresby'. This dredge has been described in detail by Borley.[1] Small naturalists' dredges and oyster dredges were also taken, the former for boat work.

Fish Traps of various sizes were constructed for use from the 'Discovery', and it was hoped that good results would be obtained with them in comparatively deep water. The largest was 10 ft. by 4 ft. by 4 ft., made of galvanized angle iron and netting; it was only used once and was then unfortunately lost. It had been buoyed in deep water off South Georgia, and with the onset of heavy weather two days elapsed before it could be picked up. The buoy was discovered far away from its proper position and the wire, though of over 2 tons breaking strain, was found to have parted. There is little doubt that its loss was due to an iceberg having drifted across the position. It is hoped that opportunity will be found for further experiments with large traps in deep water. Off the north-east coast of South Georgia the bottom between depths of 300 and 2000 m. is exceedingly rough and traps appear to afford the only means of obtaining those animals which can escape a dredge. Smaller traps were 4 ft. by 4 ft. by $2\frac{1}{2}$ ft., covered with $\frac{1}{2}$ in. wire netting, and three different sizes of a cylindrical pattern, covered with brass gauze. The latter were (i) 3 ft. by 1 ft. with $\frac{1}{8}$ in. mesh, (ii) $1\frac{1}{2}$ ft. by 6 in. with $\frac{1}{16}$ in. mesh, and (iii) 9 in. by 3 in. with $\frac{1}{34}$ in. mesh. These were used in shallow water, the largest sizes proving the most effective. They were generally baited with whale meat.

Nippers and Clamps. In trawling from the 'Discovery' a nipper was used to transfer the towing strain to a light rope stopper which broke at about 35 cwt., the arrangement being that shown in *Science of the Sea*.[2] If the trawl hitches the stopper breaks, the

[1] Borley, *Min. Agric. Fisheries: Fishery Invest.*, ser. ii, IV, no. 6, p. 5, 1923.

[2] *Science of the Sea*, p. 276, fig. 195, London, 1912; 2nd ed., p. 315, fig. 193, Oxford, 1928.

wire pays out from the drum of the winch, and the gear can often be recovered without serious damage. The nipper was made by Bullivant and Co. and is of the type illustrated in the figure quoted above. It has a double cam action and releasing plate, and the jaws have two grooves to suit $1\frac{1}{2}$ and $1\frac{1}{4}$ in. wire. Another type, with grooved brass wedges driving into a steel casing, was tried, but could not be made to grip the wire satisfactorily. A smaller nipper, also with cam action, and with brass interchangeable jaw plates, was occasionally used for the 4 mm. and 6 mm. wires; but the simple screw-clamp, shown in Fig. 26, was at least as easy to manipulate. With these light wires the nipper or clamp was for the most part only required when some misadventure made it necessary to take up the outboard strain.

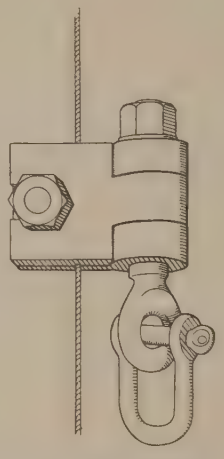


Fig. 26. Simple screw-clamp for light wire ropes.

Fig. 27. Hand harpoon with swivel head.

Hand-Nets, Harpoons, etc. Hand-nets and lines were of course frequently employed and a sort of mussel rake, with heavy teeth and a triangle of wire netting extending from the cross-piece to the handle, was useful for collecting organic growth attached to hulks and to the piles of jetties. Equipment for obtaining porpoises and dolphins was taken, including a small harpoon gun of the type used in hunting the bottle-nose. The hand harpoons were provided with a swivel head, as shown in Fig. 27, which gives a very effective grip: in use one end of the head is tied back to the shaft with a piece of thin twine.

WHALE-MARKING

As already explained (p. 147), one of the objects for which the 'William Scoresby' was built was to undertake whale-marking—the only means by which the migrations of whales can be traced with any certainty. Preliminary experiments made in 1925 indicated that the best way of attempting to mark whales would be by shooting a mark into the blubber. An ordinary 12-bore gun was found suitable and trials were made on a shooting range with various patterns of mark. Portions of blubber obtained from whales stranded on the British coast were used as targets, and eventually the form of mark shown in Figs. 28 and 29 was evolved.

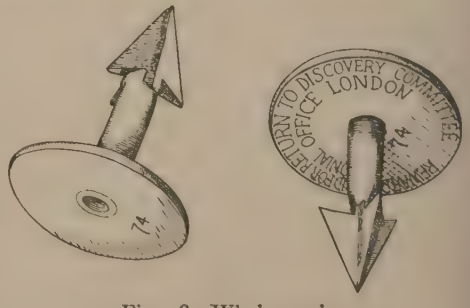


Fig. 28. Whale marks.

As will be seen the mark resembles a large drawing pin. The disc is $1\frac{3}{4}$ in. in diameter and the shank $2\frac{1}{2}$ in. long and $\frac{5}{16}$ in. in diameter, provided with three large barbs. The disc bears a serial number on both sides, and on its underside, where it is least likely to be affected by corrosion, the inscription "Reward for return to Discovery Committee, Colonial Office, London". The precise form of the barbs was the subject of prolonged experiment: a number of kinds were tried and it was found that quite small variations in form produced large differences in the amount of grip exerted on the blubber. In this respect barbs which folded back along the shank showed no superiority over those which were fixed, and the latter were to be preferred on the ground of expense. The selected pattern has a very powerful grip and can hardly be removed from the blubber by any means except cutting. The marks are made of annealed iron and silver-plated. Brass was rejected on account of the danger of copper poisoning in the wound, which might ultimately result in the mark dropping out.

The mark is used in conjunction with a light wooden shaft (Fig. 29), provided with three wads and sufficiently long to extend the whole length of the bore. The end of the rod fits into a small hole in the centre of the upper side of the disc, the mark itself lying just outside the muzzle when the gun is loaded for use. The wooden shaft breaks off short on impact, leaving the mark embedded in the blubber.[1] The guns are single-barrelled, with the sights heightened so as to give a clear view over the edge of the disc.

With this mark and gun and a cartridge containing 1 dram of black powder, the trajectory is reasonably flat at ranges up to about 75 yards, this being approximately the maximum distance at which whales are harpooned in commercial operations. It was found that when the target is hit obliquely the mark tends to straighten itself, coming to rest in nearly every experiment that was made with the disc flush with the surface of the blubber.

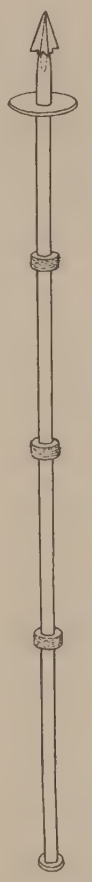


Fig. 29. Whale mark fitted to wooden shaft.

Marks and guns were supplied by Messrs Holland and Holland, Ltd., who gave expert technical advice and lent their shooting range for the experimental work.

First attempts at the use of this equipment on board the 'William Scoresby' were not very promising, one of the greatest difficulties being the amount of icy-cold spray taken over the bows in any but the smoothest water. This was overcome at the end of the first commission by the erection of a light forecastle head, as shown in Plates XIV and XV, and very satisfactory results were obtained in the early months of 1928 during the brief periods which could be allotted to this work. In the near future it is hoped to undertake

[1] It may be added that Capt. T. Sörrle, Manager of the whaling station at Stromness in South Georgia, has taken great interest in whale-marking experiments, and has devised a new form of mark with folding barbs designed to fit down the bore of the gun. Experiments with this mark are now being made.

marking on a more extensive scale. It will be understood that the method cannot be regarded as beyond the experimental stage until it has been demonstrated that the marks are retained in the blubber for at least some months.

HYDROLOGICAL INSTRUMENTS AND METHODS

Methods and apparatus in hydrology are more nearly standardized than those employed in biological work, and in consequence call for less detailed description.

Apparatus for Bottom Sampling. The apparatus used for obtaining bottom samples in routine work was supplied by the Admiralty. In shallow water, up to about 500 m., the sinker shown in Fig. 30 was employed. This sinker is 28 lb. in weight and the upper part is composed mainly of lead. At the lower end is a short cylinder, of $2\frac{3}{4}$ in. internal diameter, in which the bottom sample is collected. This cylinder has a pair of butterfly valves *a* at the lower end to prevent the sample from washing out during its passage to the surface, and a series of holes *b* at its upper end to allow the water to escape when it strikes the bottom.

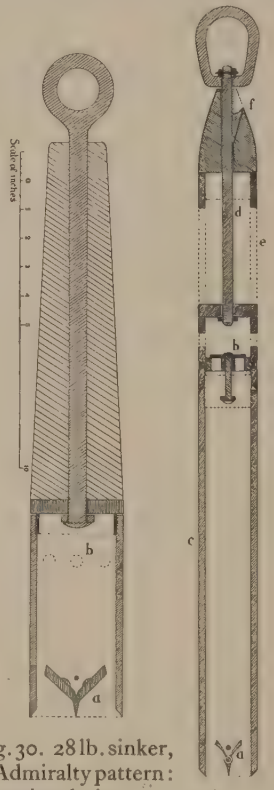


Fig. 30. 28 lb. sinker, Admiralty pattern: sectional view.

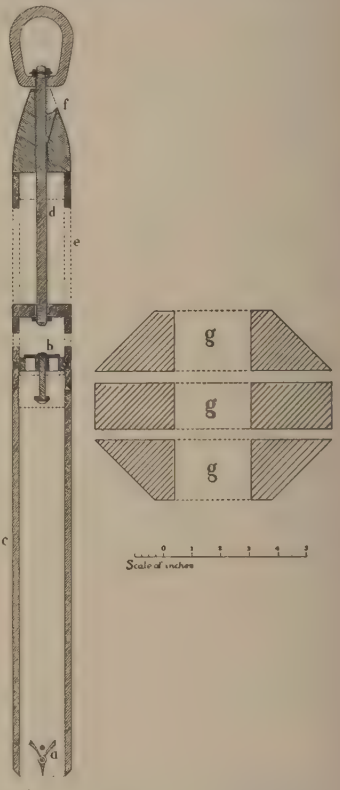


Fig. 31. Baillie rod for deep-water soundings: sectional view. For explanation see text.

In deep water greater weight is required, and with the very light wires used in sounding it is not possible to haul the weight back to the surface without risk of breaking the wire or damaging the sounding machine. The Baillie rod, which was used for deep-water soundings, is illustrated in Fig. 31; it is itself only 10 lb. in weight and is used in conjunction with separate cast-iron sinkers which are detached on striking the bottom. The rod itself is hollow throughout the greater part of its length; it has a pair of butterfly valves *a* at the lower end to retain the bottom sample, and a mushroom valve *b* at the upper end to allow the water to escape. The tube below the mushroom valve can be unscrewed from the upper part, and when this has been done, a long panel or shutter *c* can be removed, giving access to the bottom sample within. The shaft *d*, which bears the eye for the attachment of the sounding wire, is free to move vertically within the limits set by a cross-piece at its lower end, which engages in slots *e* cut in either side of the casing. To the shaft is attached a small projection *f*,

and this, when the shaft is at its lowest, is housed within the conical upper part of the instrument. The cast-iron sinkers *g* each have a hole in the middle through which the rod passes and they are suspended by a bight of wire to the projection *f*. When the instrument strikes the bottom the rod is driven backwards, the wire is disengaged from *f* by the conical head-piece, and the sinkers are detached. As will be seen from the figure the sinkers are of two shapes, conical and flat, the former being 23 lb. and the latter 20 lb. in weight. For most deep-water soundings it was customary to use four sinkers—two cones with two flats between.

These two pieces of apparatus proved very reliable: except on rocky ground they rarely failed to provide a sample of the bottom.

Snapper leads, with both fixed and detachable weights, were also used on a few occasions, but appeared to be less certain in their action. The "Sondeur Leger",[1] a light form of grab originally constructed for the Prince of Monaco, was sometimes employed for obtaining larger samples of the bottom in shallow water, but as already stated the conical dredge was used for this purpose during the trawling operations of the 'William Scoresby'.

For obtaining cores of ooze in deep water an instrument similar to that described by Ekman[2] in 1905 was constructed. It is similar in principle to the Baillie rod, but is much longer and carries glass tubes inside which can be withdrawn without disturbing the enclosed bottom sample. This instrument, which is illustrated in Fig. 32, differs from the Ekman-Nansen pattern in that the weight is detachable—a necessity for deep-water work. As in the Baillie rod there is a mushroom valve at the top of the tube; closure at the bottom end is effected by two cup-shaped valves, actuated by a spring and similar to those used in snapper leads, which slide down the outside of the tube when the sinker is released. The rod is 5 ft. 2 in. in length and contains three 15 in. glass tubes separated by thin leather washers. The internal diameter of the glass tubes is about $1\frac{1}{4}$ in., and the pear-shaped cast-iron sinkers are 53 lb. in weight. The instrument was made by the Telegraph Construction and Maintenance Co. and with it cores up to 47 cm. in length have been obtained. Deeper penetration could perhaps be effected by using a heavier weight and a tube of smaller diameter.

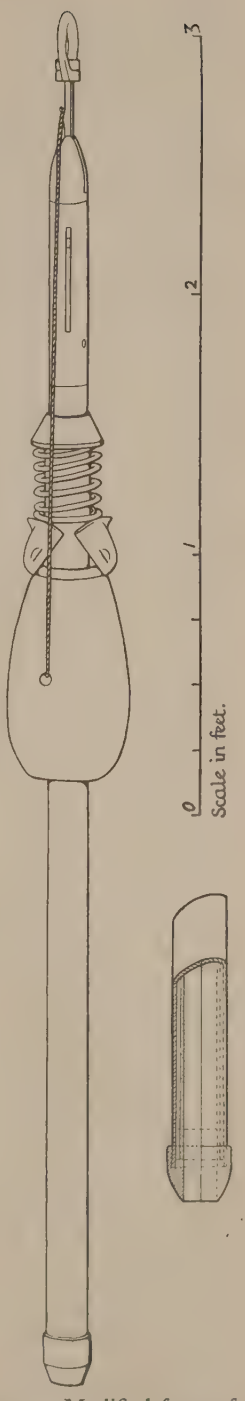


Fig. 32. Modified form of Ekman-Nansen sounding rod, for obtaining cores of ooze in deep water.

[1] Richard, *Les Campagnes scientifiques de S.A.S. le Prince de Monaco*, p. 17, figs. 12–14, Monaco, 1910.

[2] Ekman, *Pub. Circ., Cons. Explor. Mer*, 27, pp. 1–6, 1905.

Water Bottles and Thermometers. Water bottles were supplied by Dr Martin Knudsen from the Laboratoire Hydrographique at Copenhagen and are of three kinds: the Nansen-Pettersson insulating water bottle, the Ekman reversing water bottle and the Knudsen full speed water bottle.

In the Nansen-Pettersson instrument the water sample is insulated by a number of concentric jackets and the temperature is read by a thermometer of normal type inserted in the top of the water-chamber. This pattern is made for attachment to the end of the wire and in consequence only one instrument can be used at a time; it can, however, be shot and hauled very rapidly since the thermometer will take up the temperature while being hauled to the surface. If used in deep water the temperature is liable to rise, owing to the heat given off by the expansion of the water as the instrument is hauled to a higher level; it was, however, never used at greater depths than 400 m., the error arising from this cause being then negligible.

The water bottle is of the type described and figured by Knudsen in 1923.[1] The release mechanism in this pattern is effected by a messenger with a conical excavation in the bottom, which impinges on a small striking plate set in the conical headpiece of the bottle. This mechanism was not considered entirely satisfactory and a different form, in which a flat-bottomed messenger strikes a horizontal lever, was substituted. It is believed that a similar arrangement has been adopted in the latest models. The Nansen-Pettersson bottle proved most reliable on both vessels, thousands of temperatures and water-samples being taken without the smallest hitch.

For deeper water the Ekman reversing bottle was used, the model also being that described by Knudsen in 1923.[1] In this pattern the cylinder in which the water is collected capsizes when the messenger reaches the instrument, and the thermometers, two in number and carried in brass tubes attached to the cylinder, are capsized also. The thermometers are of a special type in which the mercury column is cut off at a particular point when they are reversed, and the only alteration in the reading while the instrument is being hauled to the surface is that due to the contraction or expansion of the cut-off column of mercury. In order to correct this error, which is always small, a secondary thermometer is sealed up in the same tube as the main thermometer, the correction being calculated from the two readings by means of a simple formula.

A single bottle of this type cannot be operated so quickly as one of the insulating pattern, for it must remain at the desired level until the thermometer has taken up the temperature. The bottles, however, are made so that they can be clamped on the wire at any point, and each is fitted with a device by which a messenger can be released on the wire below it. In consequence a series of bottles can be used at a single operation, and in deep-water work a great saving of time is effected.

The Ekman reversing bottle is a most reliable instrument. The only defect noted is that the cylinder is if anything too evenly balanced on its pivots, with the result that there were occasions when it failed to engage in the clip on the lower part of the frame

[1] Knudsen, *Pub. Circ., Cons. Explor. Mer*, 77, pp. 1–16, 1923.

when it was reversed. This was remedied by the addition of a small weight, after which no further difficulty was experienced.

The Knudsen full-speed water bottle[1] was tried on a number of occasions in the 'Discovery', but it was found that the manometers, which indicate the depth at which the samples are taken, failed to give accurate records. If this defect, which possibly does not exist in other instruments of the same pattern, can be overcome, this type of bottle should give valuable results.

The thermometers used with the water bottles were all made by the firm of Richter and Wiese of Berlin, who also supplied the unprotected thermometers which were used, as explained on p. 198, for determinations of depth. The simple thermometers used with the Nansen-Pettersson bottle are of two patterns, one having a range of $-2°$ to $+32°$ C., for use in tropical and sub-tropical waters, and one with a range of $-2°$ to $+20°$ C. for use in colder areas. The reversing thermometers have a range of $-2°$ to $+16°$ C. All the thermometers are scaled to $0{\cdot}1°$ C. and provided with certificates from the Physikalisch-Teknische Reichsanstalt.

In all work at stations the Nansen-Pettersson bottle was used for taking surface samples. For observations between stations, when the ships were under way, a sample was taken in a leather bucket and the temperature read with thermometers made by Messrs S. and A. Calderara. These thermometers are scaled to $0{\cdot}2°$ C. and have certificates from the National Physical Laboratory.

Transparency or Secchi Disc. This apparatus, which is used to determine the transparency of the water, consists merely of a circular disc, painted white and 50 cm. in diameter, which is lowered in a horizontal position to the depth at which it just ceases to be visible. It is extremely easy to manipulate, but recent investigations have unfortunately shown that the reliability of the method is open to doubt. In studying the penetration of light into sea water, Poole and Atkins[2] have endeavoured without success to correlate observations made with the Secchi disc with those obtained with their photo-electric apparatus.

Hydrological Methods.[3] Water samples and temperatures in routine work were usually taken at depths of 0, 10, 20, 30, 40, 50, 60, 80, 100, 150, 200, 300, 400, 600, 800 and 1000 m. and thence at 1000 m. intervals to the bottom. Samples of water for determination of salinity, hydrogen-ion concentration and phosphate-content were taken in 6 oz. swing top milk bottles, and tie-on labels were used giving particulars of station number, date and depth. Samples for oxygen work were preserved in numbered glass-stoppered bottles, each with a certificate of its volume, placed in a corked outer flask.

The analysis of water samples was for the most part carried out at the Marine Biological Station, South Georgia. In the 'William Scoresby' with her scanty accommodation it was not possible to do any of this work, but in the 'Discovery'

[1] Knudsen, *Pub. Circ., Cons. Explor. Mer*, 50, pp. 1–11, 1909.

[2] Poole and Atkins, *Journ. Marine Biol. Assoc.*, n.s., XV, p. 480, 1928.

[3] We are indebted to Mr H. F. P. Herdman for assistance in this section.

determinations of hydrogen-ion concentration were regularly made, and during a considerable part of the commission all samples were titrated on board for salinity. On certain occasions when the vessels were at Cape Town titrations for salinity were made in the physical and chemical laboratories of Cape Town University, while oxygen samples were worked up in the Government Chemical Laboratory. Thanks are due to Prof. E. Newbery and Dr Marchand for these facilities.

Salinity was determined by the method described in detail by Oxner and Knudsen,[1] in which the samples are titrated against a solution of silver nitrate of known strength, a solution of potassium chromate being used as an indicator. The strength of the silver nitrate is determined previously by titration against standard sea-water of a definite chlorine value supplied by the Laboratoire Hydrographique at Copenhagen. The special burette used in the work is graduated to give the chlorine value as a direct reading, and tables have been drawn up by Knudsen[2] from which the salinity can be quickly calculated from the titration. A special pipette for drawing off the required amount of water from the sample is also used, both burettes and pipettes being supplied by the Laboratoire Hydrographique.

Analysis of samples for dissolved oxygen was carried out by Winkler's method. The samples are fixed on board by the addition of small quantities of each of two solutions, manganous chloride and a mixture of sodium hydroxide and potassium iodide. Manganous hydroxide is immediately formed, and on absorbing the oxygen becomes manganic hydroxide. In order to prevent air from entering the sample bottle, it is placed in a flask filled with water from the same depth and corked until required for analysis. The fixed sample will keep for some considerable time. In the analysis the sample is well shaken after the addition of concentrated hydrochloric acid. The manganic hydroxide is broken up and manganic chloride formed, the latter immediately reacting with the potassium iodide present and setting free iodine. Titration against a standard solution of sodium thiosulphate, using starch as an indicator, will give the amount of iodine liberated, and hence, by a simple calculation, the percentage of oxygen in the sample.

Phosphate content was estimated by Atkins' application of Denigès' method,[3] in which the amount of phosphorus pentoxide is found by comparing the blue colour formed on the addition of two solutions to tubes containing (*a*) the sample of sea water and (*b*) a solution of potassium dihydrogen phosphate of known strength. By adjustment of the heights of the columns, which is easily done in Hehner tubes fitted with stopcocks, the intensity of colour in the lengths of the columns can be matched with accuracy. The solutions used are ammonium molybdate in 50 per cent sulphuric acid and tin dissolved in hydrochloric acid with the addition of a drop of copper sulphate.

[1] Oxner and Knudsen, *Bull. Comm. Internat. pour l'Explor. sci. de la Mer Méditerranéenne*, no. 3, pp. 1–36, 1920.

[2] Knudsen, *Hydrographische Tabellen*, Copenhagen, 1901, and *Pub. Circ., Cons. Explor. Mer*, 11, 1904.

[3] Atkins, *Journ. Marine Biol. Assoc.*, n.s., XIII, pp. 119–50, 1923, and Harvey, *Biol. Chem. and Physics of Sea Water*, p. 42, Cambridge, 1928.

Observations on hydrogen-ion concentration were made colorimetrically owing to the impossibility of setting up delicate electrical apparatus on board ship. Special sets of sealed standard tubes, made up from Palitzsch's buffer solutions[1] of borax and boric acid and a 0·02 per cent solution of phenol red as indicator, were supplied by British Drug Houses, Ltd., and renewed several times during the commission. These had a range of *p*H 6·8 to 8·4, ascending by 0·05. A thymol blue range was also used, giving a range of *p*H 8·0 to 9·0. The method employed in determining the *p*H value of a sample was to measure out 10 c.c. from an accurate pipette into a test tube of the same internal diameter as the tubes of the standard range. A fixed quantity of indicator (varying with each set of standard tubes) was then added, and the tube compared with the standards by the light of a "daylight" electric bulb shining indirectly from behind, with the rest of the laboratory in darkness.

SURVEY EQUIPMENT

Existing charts of the Dependencies of the Falkland Islands are deficient in many respects, and with a view to their improvement the services of a trained surveyor were placed at the disposal of the Discovery Committee by the Admiralty. This officer, Lieut-Comdr. J. M. Chaplin, R.N., was Navigator and (later) Chief Officer on the 'Discovery'.

Opportunities for hydrographic survey were necessarily limited by the fact that the vessel was almost continuously engaged in work on hydrography and plankton, but during the last commission useful work was done at various times in the 'Discovery', and on a number of occasions it was found possible to free the survey officer from his duties on board, thus enabling him to carry out coastal surveys in the Dependencies.

In South Georgia particular attention was paid to harbours, hitherto uncharted, which are habitually used by vessels of the whaling fleet, and since these are for the most part uninhabited it became necessary to establish temporary camps. Small tents, sleeping bags, stoves and other gear from the ship's sledging equipment were used in these operations, and provisions were worked out with a margin of at least 30 per cent above the full supply for the agreed period, in view of possible difficulties in affording relief. The personnel of these survey expeditions consisted of the survey officer, a cadet and one seaman, accompanied sometimes by the ship's doctor and by a member of the scientific staff. A light pulling boat—a Norwegian pram—was taken, fitted with a small Lucas sounding machine, together with an 8 ft. tide pole and poles and flags for beacons and marks.

The surveying instruments were supplied almost entirely by the Admiralty and most of them do not require description. We are indebted to Lieut.-Comdr. Chaplin for the following notes:

Of the theodolites the Zeiss 3 inch transit theodolite no. 1, with automatic mean reading, was used most extensively: it was found to possess great accuracy, and its light weight and compactness were important factors. Owing to the friable nature of the rock in South Georgia no attempt was

[1] W. Mansfield Clark, *Determination of Hydrogen-ions*, pp. 115, 117, Baltimore, 1923.

made to obtain heights by theodolite except at sea level. The pocket aneroids were therefore most useful for determining such heights and contours: the pocket sextant was also useful in similar circumstances.

The Dover compass was satisfactory, but was found after the first passage to have worn the pivot flat through the constant rolling of the ship.

The station pointers were the only instruments which gave any trouble. The brittleness of the metal owing to cold and the hardening of the lubricant caused the arc attached to the legs of one instrument to crack and rendered it useless until roughly repaired.

One notable point was the long life of the silvering on all the sextant mirrors, due partly to the very able work put into them and also partly to the dryness of the atmosphere.

The chronometers deserve special mention. All of them without exception worked extraordinarily satisfactorily and especially the chronometer marked *C*, which was taken on the first camping expedition as an experiment. So far as could be seen the rate hardly varied at all. Every precaution was taken to keep the temperature even, but it can be realized that under canvas the temperature is bound to conform to that in the open air even through blankets and padded cases. The chronometer was kept in the cooking tent and wound after cooking was finished in the morning, i.e. when the tent was at its warmest. The rate was compared twice or three times with Nauen or Lyons before leaving and again on returning, and was never found to have varied much: it was low to begin with, in the region of 0·1 sec. per day, which of course was good.

One point to be observed in this connection is that the W/T time signals in Schollaert Channel and generally in the Palmer Archipelago were heard with greater strength and clearness than anywhere else.

The tide readings were always a source of difficulty except in Leith Harbour, South Georgia, where the pole was secured to a wooden wharf. In other harbours it was erected with its foot below low-water mark and secured with stones tied round the foot and guys at suitable angles. Unfortunately the male elephant seals in South Georgia seemed to have a dislike for it and frequently we found the pole down in the morning, or waking up would find elephant seals in the act of pulling it down. This did not affect the reduction for soundings but rendered the readings useless for calculating tidal data even if we had been able to get a sufficient number.

During the course of the work it was never cold enough to make the use of the leather protection on eyepieces and screws necessary. For the latter a pair of washleather gloves afforded sufficient protection to the fingers; if leather was used it was found that it became dry and rendered round the screws, thus increasing the awkwardness of working with cold fingers.

The only improvement in the equipment that can be suggested is that a small W/T receiving set should be taken on any future expedition which will involve camping away from the parent ship or whaling station.

LABORATORY METHODS

On board ship laboratory accommodation is necessarily limited, and except in very fine weather the rolling of the vessel renders any elaboration of technique impossible. In intensive plankton work rapid disposal of the material is a first essential: the collections must be dealt with in bulk and even the most cursory examination of the material must frequently be postponed.

Sorting Collections. As a general rule the contents of 1 m., 70 cm. and 50 cm. tow-nets were preserved in bulk, sometimes with the subtraction of specimens of unusual interest, and often (more particularly with the 1 m. nets) with the omission of species, such as Salps, *Euphausia* and *Euthemisto*, which by their abundance swelled

the volume of the catch beyond all reasonable dimensions. When specimens were subtracted from a tow-netting a note was made on the back of the label and in the biological log book. Hauls with the larger plankton nets and most of the bottom organisms obtained in dredges or trawl were usually sorted on board, specimens of different groups being placed in separate tubes or bottles and noted in the log book.

In plankton work in whaling areas, where it was necessary to form some idea of the contents of the nets without waiting for detailed analysis, a preliminary examination was made on board as soon as an opportunity presented itself. The variety of organisms in the 1 m. nets was generally not great, but one species or another frequently occurred in prodigious numbers and it was often difficult to arrive at a fair estimate of the quantity present. The procedure adopted was to find how many organisms were required to displace a given amount of water and then to determine the number of the remainder by a similar method of displacement. This system worked well, but the individuals of a particular species taken in one haul often differed considerably in size from those of the same species taken in another, so that it was usually necessary to repeat the initial count for each gathering examined. With tow-nettings made with the 70 cm. and 50 cm. nets the volume of plankton was measured after the larger organisms had been extracted and a rough estimate made of the proportionate abundance of the different organisms expressed in percentages of volume.

In the **Fixation and Preservation of Specimens** no novel methods were employed, but experiments were continually being made, and it will perhaps be useful to include some notes on the subject. The Antarctic fauna is exceedingly rich; a successful haul of the trawl entailed much heavy work and it was often difficult to find time for any but the simplest technique. On one occasion, off Clarence Island, a dredge was shot in 342 metres. It was only on the bottom for some five minutes, but yielded such a huge mass of material that three of the staff were kept fully occupied for over twenty-four hours.

The anaesthetic most commonly used was menthol. Crystals sprinkled on the surface of the water gave excellent results with many groups of animals, particularly with Actinians, Alcyonaria, Hydroids, Polychaetes and Holothurians. Generally it was found best to leave the bowls of animals on deck in a cool temperature, but Polychaetes react very slowly under these conditions. If brought into the laboratory they were always perfectly anaesthetized in about twelve hours.[1] For Pteropods a few drops of 1 per cent chloral hydrate gave splendid results and crystals of chloral hydrate often worked well with Nemertines. For Nudibranchs and Tectibranchs menthol proved reasonably efficient, but great difficulty was experienced in obtaining well-extended specimens of Gastropods in shells. On a few occasions moderate success was obtained by menthol, followed by a slow and careful addition of strong spirit to the surface of the water. This, however, could only be done on the swing table and in fine weather.

[1] By this method, however, the proboscis is rarely found extruded, a condition which facilitates systematic examination.

For fixation 10 per cent formalin and weak spirit were the reagents most commonly employed. Speaking generally the formalin was used for soft-bodied animals and those that had been anaesthetized, and the spirit for Sponges, Crustacea, Echinoderms and other animals in which delicacy in tissue fixation was not required. The hardening properties of formalin render it a most valuable reagent, and as a fixative it is to be recommended even for animals with calcareous spicules, such as Alcyonaria and Holothurians, which if permanently preserved in it would be ruined. Fish and all malacostracous Crustacea are best fixed in weak spirit, but even in these groups formalin has its uses: deep-water pelagic species are frequently very soft and are much improved by a preliminary hardening in formalin. For many delicate planktonic organisms a salt-water solution of formalin was employed. This proved very satisfactory with *Leptocephalus* larvae, which always blister if fresh water is used. With some of the transparent pelagic Polychaetes no success could be obtained with menthol, but they turned out well if a little weak formalin was added to the salt water. Other Polychaete worms, when fully anaesthetized, were straightened out with a brush on a filter paper saturated in formalin, more formalin being added as soon as they had acquired sufficient rigidity.

Special methods of fixation were adopted for certain animals and for those which seemed to possess particular anatomical interest. Of these Bouin's fluid was most frequently employed, and was very successful with a large range of organisms. It proved excellent for the polypides of *Cephalodiscus* and it gave such good results with Diphyids that it was adopted so far as possible as a routine method. Salps of soft consistency were frequently fixed in Bouin and afterwards preserved in formalin. For Crustacea and their larvae Bouin's formula was replaced by that of Duboscq, and for Turbellaria, Cestodes and Trematodes one of the corrosive mixtures (Schaudinn or Petrunkewitsch) was used. Hot 70 per cent spirit was used for the fixation of Nematodes. As recommended by Lo Bianco, Crinoids were fixed by quick immersion in strong spirit and, with some species at least, this appears to be the only method by which perfect specimens can be obtained. With most of the Ctenophores indifferent success was attained; some kinds could be fixed in formalin and transferred afterwards to spirit, while others, though they shrank greatly in the process, gave moderate results with Bouin's fluid; others, however, seemed to defy all attempts at preservation.

As permanent preservatives 10 per cent formalin and 75 per cent spirit were almost invariably employed. Most organisms were preserved in spirit, and those that had been fixed in formalin were usually placed for a time in weak spirit before being transferred to the stronger solution. To bring specimens through more gradations of spirit was usually impracticable and it was only attempted with those that were of special interest. Neutralized formalin was used as a permanent preservative for Medusae, Copepods, for transparent pelagic animals such as *Sagitta*, *Tomopteris* and *Carinaria*, and for bulk collections of plankton. The contents of large plankton nets were partially sorted on board and the Crustacea, Cephalopods, fish, etc., preserved in spirit.

The Alcohol used for making the 75 per cent solution was the ordinary commercial

product from which methylated spirit is made, but without the addition of any methylating substances. In strength it varied from 94 to 95 per cent, and it was carried in 10 gallon drums. These drums gave a considerable amount of trouble, for in less than a year many of them rusted on the inside and the spirit became turbid with fine rust in suspension. At sea there was no opportunity for the rust to settle and for a time it was necessary to filter all supplies. Later, a galvanized tank was supplied to the 'Discovery' and filled with clear spirit whenever the ship was in port.

The **Formalin** was neutralized, as recommended by Atkins,[1] by the addition of 5 grm. of borax to every litre of undiluted solution. Experience showed that special care must be taken of formalin in the Antarctic. During the first season it was discovered that a large proportion of the formalin which had been stowed in carboys on the boat-skids of the 'Discovery' had become converted into paraformaldehyde, forming a white insoluble precipitate which cannot apparently be reconverted into its original form. It became necessary to filter the supplies, and with some carboys almost half the quantity was lost in the process. The same thing occurred with formalin which had been left in cases out-of-doors at the Marine Station, South Georgia. So far as can be ascertained the difficulty is due to low temperatures, for formalin kept in the ship's hold, or indoors at the Marine Station, did not deteriorate.

Storage of Specimens. All smaller organisms were preserved in tubes or bottles. Flat-bottomed tubes of all sizes from $1 \times \frac{1}{4}$ in. to $6\frac{1}{2} \times 1\frac{1}{2}$ in. were used and these tubes, when filled, were plugged with a ball of cotton-wool wrapped up in tissue paper and stored in bottles. The reason for wrapping the wool plug in tissue paper is that certain organisms entangle themselves in wool and cannot afterwards be freed from it without damage. This method is to be preferred to corks, which sometimes cause discoloration of specimens and are liable to shrink and allow the contents to dry up. If wool is placed at the bottom and top of the bottles in which the tubes are stored, the danger of breakage is very slight. These tubes were used for bulk plankton as well as for isolated specimens, but they are better adapted to the latter than the former. Plankton might more conveniently be stored in $\frac{1}{2}$ lb. screw top bottles, a method which would save a great deal of the labour involved in reducing samples to a small volume. Copper funnels with short and wide necks were found most useful in the reduction of plankton samples. Those used were 6 in. and 4 in. in diameter of mouth and $1\frac{1}{2}$ in. and $\frac{3}{4}$ in. respectively in diameter of neck. After the bulk of the fluid had been filtered off through fine silk the remainder of the sample was poured into a tube or jar through one or other of the funnels.

Extra long tubes, $1\frac{1}{2}$ in. in diameter and 12, 18 and 24 in. in length, were taken for the preservation of long and slender animals, and for these corks had to be used. These tubes were sealed by dipping the ends in melted wax, and they were specially packed

[1] Atkins, *Journ. Marine Biol. Assoc.*, n.s., XII, pp. 792–4, 1922.

in boxes which were always kept right end uppermost. The long tubes were used for many animals, but more particularly for Alcyonaria, Crinoids, large worms and deep-sea fishes.

Seven standard sizes of bottles were carried, the types being those shown in Fig. 33. Most in demand were the four kinds with screw tops (*a–d*), which have capacities respectively of 1 lb., 2 lb., 3 lb. and 5 lb. These have a rubber washer and glass lid kept tight by a screw ferrule and are similar to those used for preserving fruit. The ferrules,

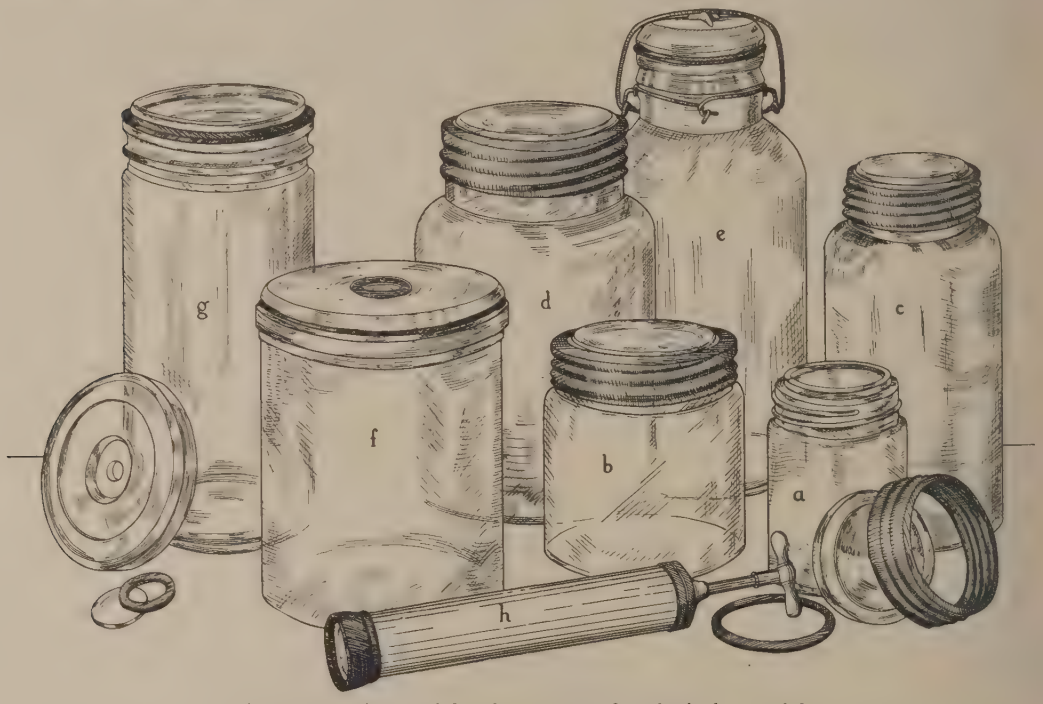


Fig. 33. Bottles used for the storage of zoological material.

which are ordinarily made of lacquered tin plate and rust rapidly under sea-going conditions, were specially manufactured in copper. In the bottle shown in Fig. 33 *e*, which was used mainly for large samples of plankton and for the preservation of fine material obtained in small nets attached to the trawl, the glass lid is kept in position by a simple but very effective spring clip made of galvanized wire. This type, if made in a sufficient range of sizes, and with larger lids, would be ideal for biological purposes. Bottles *f* and *g* have glass lids and rubber washers like the others, and in the middle of the lid a recessed perforation covered by a circular glass disc resting on a small rubber washer. The bottle is made tight by means of a small exhaust pump *h* placed over the centre of the lid: when this pump is used the glass disc forms a non-return valve and a partial vacuum is created inside. These bottles were stocked not because the vacuum device was thought an advantage, but because their shapes rendered them particularly valuable for biological work. Fish nearly 10 in. in length can be put in one of them, while the other, with a mouth more than 5 in. in diameter,

was very useful for echinoderms, sponges and other bulky organisms. The vacuum system appears to do no harm to zoological specimens—it may even assist in the penetration of the preserving fluid—but in practice it proved troublesome. When a bottle was first closed a slight leakage frequently occurred and this, in time, would break the vacuum and allow the lid to fall off. To seal the bottles properly required much care, but when once it had been done they remained tight indefinitely. All the bottles were stored in partitioned boxes lined with thick felt (see p. 170).

Larger specimens were preserved in stoneware jars and tanks. The jars were made by Messrs Price, Powell and Co. of Bristol and were of 3 gallon capacity, with mouth 6 in. in diameter. The stoneware lid was kept tight by means of a rubber washer and iron tri-radiate screw clamp. The tanks were of two sizes, some 30 × 18 × 18 in. and some 48 × 18 × 12 in.; they were mostly of cast iron, made by Messrs T. and C. Clark and Co. of Wolverhampton, but a few of the 30-in. size were of welded steel. The steel tank is preferable to the cast iron because of its greater lightness; it is, however, much more expensive. All the tanks were stove-enamelled inside; a flange round the upper edge matched a similar flange on the lid, and between the two there was a thick rubber washer cut in one piece. The lid was kept tight by a large number of bolts and fly-nuts passing through both flanges and the washer. Two large rings were attached to each side, and through these rings poles could be passed when it was necessary to move the tanks. The shorter tanks were each fitted with four trays, with sides made of teak, pegged together with wood, and with cane bottoms. They were provided in order that the upper layers of specimens should not crush those below and in this respect proved very useful. It was found, however, that teak, when soaked in spirit, gives out a dark brown colouring matter and that several changes are necessary before all has been extracted. Possibly some other wood is to be preferred, for there seem to be strong objections to the use of any form of metal in trays which are to be used with both spirit and formalin.

To accommodate the large number of specimens obtained during her trawling survey six of these tanks were installed in the 'William Scoresby'. In the 'Discovery' three were taken and spares were kept at the Marine Biological Station in South Georgia.

Heavy wooden boxes, 8 ft. in length, $2\frac{1}{2}$ ft. in breadth and $2\frac{1}{2}$ ft. in depth were carried on both vessels for salting porpoises. The seams were caulked and each had a plug in the bottom for drainage and a light lid.

Labels, Log Books, etc. Printed labels used for specimens were of 10 sizes, varying from 7 × $2\frac{1}{2}$ in. to 1 × $\frac{3}{8}$ in. They were of heavy paper of the best quality[1] and had spaces for station number, date, net and depth of net. The type of net was specified by means of the symbols shown at the beginning of the Station List (*supra*, p. 3). As a help in sorting, the name of the group, family or genus to which the specimens belonged was written in the lower left-hand corner, and occasionally a note was added

[1] The paper adopted after some preliminary experiment was that known as "Antique parchment, cream wove", supplied by Messrs Waterlow and Sons, Ltd.

on the method of fixation. All entries were made in soft pencil, B or BB, and the labels curled round inside the tube or bottle with the written side against the glass. Specimens in stoneware jars and tanks were more difficult to label permanently, for in a rolling ship paper labels sometimes get detached or become obliterated by friction. Fish stored in tanks were sewn up in cotton material with two labels, one of which was folded and placed in the mouth or behind the operculum. For other specimens serially numbered bone labels were sometimes employed and of these labels a special register was kept.

The more important log books were quarto and of two kinds. One of these, the General Scientific Log Book, contained all the particulars shown in the Station List, and, in addition, a record of all observations made between stations. In the Biological Log Book fuller details were given of all nets that were shot, with notes on the catch. Each of these books was in duplicate—a bound volume for use on board and loose sheets, punched for filing in suitable covers, which were posted periodically to London. For deck use smaller octavo books with similar ruling were employed, with pages punched on the left-hand side and perforated at the top. After the entries had been copied the sheets were torn out and filed in loose-leaf covers: they are thus readily available for reference if doubt arises regarding any particular observation. Other books on the loose-leaf principle were used for whale-measurements, whale observations, and for original records of salinity and phosphate determinations made at the Marine Biological Station.

Short notes on particular organisms were usually written on the back of the label. For longer notes, drawings, water-colour sketches and photographs a quarto loose-leaf "Note and Sketch" book was used. The entries in this book were numbered serially and a printed "Note" label, bearing the same number, was put in the tube or bottle with the specimen concerned.

Opportunities for making valuable sketches of living animals were numerous, and whenever possible advantage was taken of them. Unfortunately, interesting specimens were usually obtained at times when other work was very heavy. Ridgway's *Color Standards and Color Nomenclature*[1] was in frequent use for recording the colours of living animals. It appears to be much superior to any other book of the same kind and for marine biological work we recommend it very strongly. In spite of the great difficulties caused by the rolling of the ship, successful photographs of living specimens, up to magnifications of 6 diameters, were taken by Dr E. H. Marshall on the 'Discovery'. His apparatus consisted of a Leitz camera with 64 mm. "summar" lens and a Sanderson camera with Zeiss f 6·3 lens of 18 cm. focal length. Both cameras were generally used vertically and the illumination was by a mercury vapour lamp.

[1] Published by A. Hoen and Co., Baltimore, Md.

THE DISCOVERY INVESTIGATIONS
OBJECTS, EQUIPMENT AND METHODS

PART III. THE MARINE BIOLOGICAL STATION

By N. A. Mackintosh, A.R.C.S., M.Sc.

(Plate XVIII, text-figs. 34, 35.)

THE Marine Biological Station at South Georgia is situated at Grytviken, a small land-locked harbour in East Cumberland Bay, at the head of which lies the whaling station of the Cia Argentina de Pesca. The house, together with the Magistrate's house, Government quarters, wireless station and Argentine meteorological station, is built on a small spit of land known as King Edward Point, marking the entrance to the cove (see sketch map, Fig. 34), and was designed to accommodate seven persons—four officers and three men.

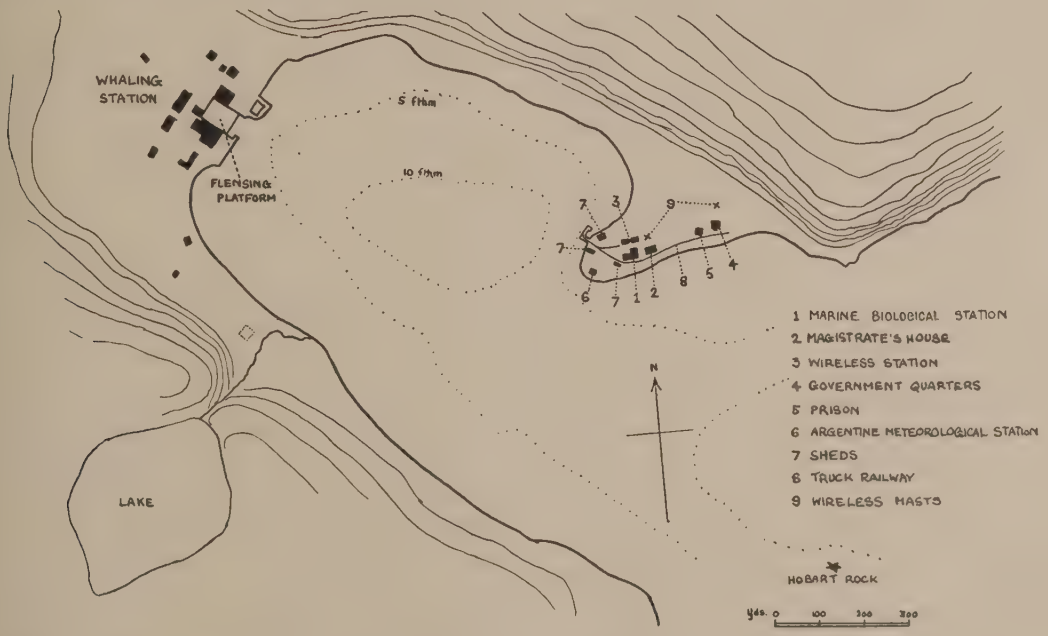


Fig. 34. Sketch map of Grytviken, South Georgia, showing positions of the whaling station, the marine biological station and other buildings.

The building (Plate XVIII, fig. 1) was constructed to designs supplied by Mr C. H. Rose, A.R.I.B.A.; it was completed in January 1925 and since then has been continuously occupied except during the winter seasons of 1926 and 1927. It is of the bungalow type, but has a large storage space under the roof. Full details of its architecture and construction need not be given here, but some remarks may be made

on the general principles which were followed. In designing the house the severe climate of South Georgia, characterized by a heavy snowfall in winter and violent winds at all times of the year, was taken into special consideration. The building consists of a stout wooden framework bolted on to a concrete foundation, and the walls were constructed with the special object of insulating the house against cold. On the outside of the wooden framework there are two layers of boarding, enclosing a layer of felt and a layer of waterproof paper, and on the inside another layer of boarding and a layer of compressed cork finished with asbestos sheeting (poilite). The interior partitions consist simply of the wooden framework covered with poilite. The roof is of galvanized iron, with a layer of boarding and insulating material beneath, and all the windows are double, having an outer iron and an inner wooden framework. These arrangements serve admirably to insulate the walls. Brickwork was used for the chimneys and walls of the boiler house, coal cellar, etc., and for part of the outside store shed.

The arrangement of the rooms is shown on the accompanying plan (Fig. 35). The house is so placed that the windows of the laboratory face the beach, and the conservatory and windows of the living rooms, while having a restricted view, are on the sunny side of the house.

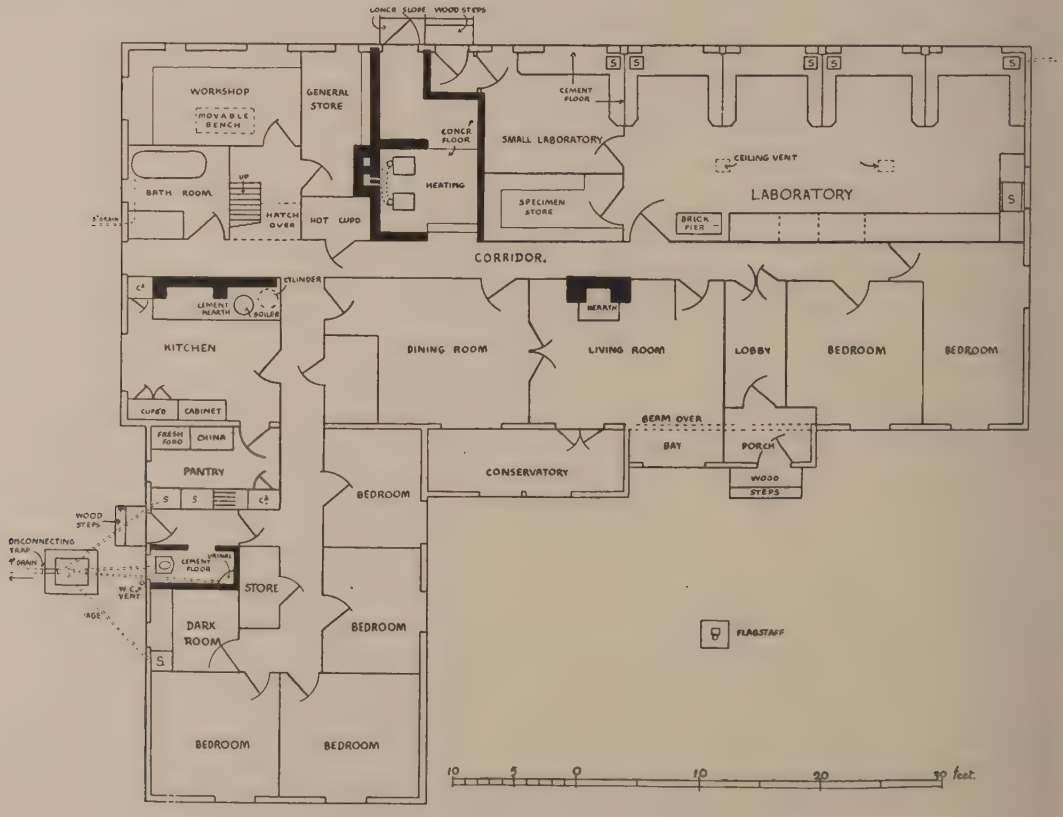


Fig. 35. Plan of Marine Biological Station, South Georgia.

In the construction of a house at South Georgia some attention needs to be paid to the accumulation of snow during the winter. Snow falls only occasionally in summer, but in winter it reaches an average depth of five or six feet, even round the coast line, and imposes a very considerable weight on the roofs of buildings. At the Biological Station the warmth of hot-water pipes in the loft prevented any very heavy accumulations of snow on the greater part of the roof, but a weak spot was found in the glass roof of the conservatory. This is situated in a corner of the house, where it catches the snow sliding down from more than one section of the iron roof. The snow frequently becomes partially converted to almost solid ice through alternate melting and freezing, and was found to crack and break the glass if it was not regularly scraped away. The snow sliding off the roof also forms large accumulations on the ground and if not removed will mount up to the eaves and obscure the windows.

The plan of the laboratories has been found very convenient. The large laboratory (Plate XVIII, fig. 2) measures 32 ft. by 15 ft. and has a series of bays along one side, each with benches, shelves, cupboards and sink. There is a long bench in the middle of the room and various shelves, drawers, cupboards, etc., on the side opposite the windows.

The main laboratory is connected with the exterior by a small laboratory. This has a concrete floor, a lead lined table and a bench with a sink. In connection with work carried on at the whaling station this small laboratory has proved indispensable. It is used mainly for handling large specimens and rough work generally. It also contains an apparatus for the preparation of distilled water, and has been used for miscellaneous operations, such as filtering formalin and preparing skins of birds and seals.

A small store room opens out of the main laboratory and is used for storing specimen bottles and chemicals.

Other rooms not included among the living rooms are the workshop and dark room. A workshop of some sort is of course essential for a station in such a place as South Georgia. That at the Biological Station is equipped with a small treadle lathe and sufficient tools for all ordinary purposes.

Little need be said of the living rooms as they do not differ much from those of an ordinary house at home. The walls of the laboratories, workshop and bathroom were painted with washable enamel, and this treatment would have been preferable throughout the building. The house is fitted with a central heating apparatus, burning coke, and there is a coal fire in the sitting room and kitchen.

The wireless station close by provides electricity for lighting purposes, and a power circuit is fitted, principally for use in the laboratory.

A pipe line from a dam a few hundred yards away on the mountain side provides water for the Biological Station, Magistrate's house and wireless station. Trouble is experienced with this from time to time during the winter. The water in the pipe will never freeze when there is plenty of snow on the ground, but in the early part of the winter, in May and June, there are often sharp frosts before the snow has accumulated to any great extent, and the ground becomes frozen down to a depth of about 3 ft. A water pipe therefore, unless it is buried at a considerable depth along the whole of its length,

is very liable to become blocked with ice. The only remedy for this is to expose the pipe and melt out the obstruction, and since no tool except a pickaxe will make any impression on the frozen ground, the task may present considerable difficulties.

Drainage is effected by a 5 in. pipe running down to the beach.

In addition to the main building of the Biological Station an outside store shed measuring 32 ft. by 13 ft. was erected, the walls being mainly of brick. This is divided into three compartments and was planned principally for the storage of fuel. More recently a larger store shed has been built close to the jetty.

Owing to the heavy winter snowfall in South Georgia buildings cannot conveniently be constructed except during the summer months. To avoid delay in erection the framework of the buildings was cut to measure in England, so that the separate pieces had only to be fitted together in South Georgia.

The Marine Biological Station possesses two boats, a 30 ft. motor launch and an 18 ft. dinghy. The care of boats at South Georgia presents certain points of difficulty owing to the exceptional climatic conditions. Sudden storms with violent gusts commonly take place and necessitate strong and reliable moorings. The launch was usually moored to a buoy about 30 yards from the jetty. It was found that the only reliable method of attachment was by a length of strong flexible wire rope. Ordinary rope is quickly chafed through by the plunging of the boat in bad weather. The launch was also moored from time to time behind the projecting arm of the jetty. This had the advantage of accessibility, but a tendency for the bottom to silt up at this point resulted in a risk of the keel or stern frame being damaged. The dinghy was usually moored by a stout painter to the end of the arm of the jetty. In winter the boats must be taken out of the water, owing to the ice which is liable to accumulate in the harbour and to the heavy falls of snow. During the first winter the boats were housed at the whaling station, but accommodation for the motor boat is now available in the newly constructed shed.

The launch was originally intended as part of the equipment of the 'Discovery'. She is carvel built of teak, with copper fastenings, and has a 28 H.P. Parsons internal combustion engine giving a maximum speed of $10\frac{1}{2}$ knots. The engine runs on paraffin, but is started up with petrol. The launch is an open one, decked only at the bow, with a folding hood to shelter the engine and seating space. She has been used partly for scientific work in East Cumberland Bay (for plankton and hydrological investigations and for trawling and dredging), and partly for transport of personnel and stores between the Biological Station, the ships and the whaling station. In this work the launch has given constant and most valuable service, though she is not altogether suited to conditions at South Georgia. A boat with greater beam, to ensure steadiness in choppy water, and fully decked except for a small cockpit, would be more convenient.

The dinghy is built of teak and is equipped with a dipping lug sail. The design of the boat was entirely satisfactory, but the sail was not used much as there is rarely a steady moderate wind at South Georgia.

Owing to the difficulty of procuring supplies regularly, it is necessary to find space for sufficient food and other consumable stores to last over considerable periods. There must also be room for large quantities of scientific stores and miscellaneous articles, such as rope, canvas, benzine, timber, nets, boats' equipment, etc. As already mentioned, the original store shed was found to be insufficient.

Some difficulty was experienced in finding a suitable place to store provisions. These were at first kept in the roof space, but as many of the hot water pipes were led under the roof the heat was found to have an injurious effect on some of the tinned articles, and all the provisions were removed to a temporary shed outside. This was found more satisfactory, though some bottled provisions were broken by frost during the winter. Provisions are now kept in the new shed by the jetty.

Articles for which the greatest amount of storage accommodation is required are those which belong to the scientific equipment, especially as it is often necessary to keep at the Biological Station sufficient boxes of preserving bottles, drums of spirit, spare nets, etc., to form a reserve supply for the ships. The main part of the roof space was occupied by boxes of specimen bottles; the drums of preserving spirit, which it was unsafe to keep in the house, were stored in one compartment of the fuel shed together with benzine, paraffin, etc. Another part of the same shed was kept for such gear as nets, dredges, coils of rope and boats' equipment, and the third compartment for coal and coke. As the last provided insufficient accommodation, it was sometimes necessary to stock bags of fuel on the ground outside. This is an unsatisfactory procedure as the bags become frozen together in winter and extremely difficult to handle.

In regard to supplies of food it was at first considered advisable that the Biological Station should be equipped with a quantity sufficient to render it entirely independent of local resources. Facilities were, however, arranged for the purchase of fresh meat and vegetables from the whaling companies and the Falkland Islands. It has been found that a full supply of preserved food is unnecessary at South Georgia, for fresh meat and vegetables can be readily obtained from several sources during the summer. Salt meat was hardly used at all, being replaced by whale meat, frozen beef from the whaling station and mutton from the Falkland Islands. An unlimited supply of whale meat is of course available throughout the season, and, if cut from a fresh carcass and hung for some days, is very palatable. Chickens can be kept at South Georgia with little trouble, and fish are often easily caught in large numbers, though they are not to be depended on. In winter these supplies are necessarily much restricted, but can be supplemented if an occasional sea-leopard is killed. The flesh of this seal is dark and coarse, but the liver, brain and tongue can be recommended.

It remains now to consider some points in connection with the scientific equipment and methods of work at the Biological Station. The work is divided into three categories: (1) investigations on whales brought in to the whaling station, (2) the chemical analysis of water samples collected by the ships, (3) general work on the fauna of South Georgia.

As may be seen from the sketch map, the Biological Station is situated about 800 yards from the whaling station. There is a rough path leading round the north side of the cove, but the station is more easily reached by boat, especially as it is often necessary to carry various gear and specimens to and fro. It will not be necessary to give here a description of the process by which the whale's carcass is disposed of, or of the details of the observations which are made, as these things will be dealt with in the forthcoming report on the work at whaling stations; but some remarks may be made on the routine of work and the equipment used.

The whale boats usually bring in their catches during the night, and work on the flensing platform begins at 6 a.m. and continues with intervals for meals until 6 p.m., or until the day's catch has been disposed of. In order to carry out the programme of observations it is necessary for two people to be present on the flensing platform, and usually one officer and the laboratory assistant attended each day while the whales were being cut up.

This work at the whaling station consists in (i) taking a number of measurements including total length, bodily proportions, thickness of blubber, etc., of each whale; (ii) noting the external characters and variations; (iii) the examination of organs and tissues; and (iv) the collection of specimens. The equipment needed for all this is comparatively simple. The most important articles are rough note-books, measuring tapes, flensing and sheath knives, whale hooks, and tubes and bottles for preserving specimens. Everything used on the flensing platform becomes soiled in a short time and loose-leaf note books with a supply of spare covers are advisable. All measurements were made in metres, and the measuring tapes, reading to 30 m., were of the linen variety and wound on large fishing reels. This is much more satisfactory than a steel tape, or any kind which is rolled up in a case, but the actual tape lasts only a few weeks if detailed measurements are being taken and a good supply is therefore necessary. Flensing knives and whale hooks are important and can be obtained at any whaling station. They are used mainly in dissecting out the reproductive organs and foetuses. Smaller knives are also necessary for cutting off pieces of tissue and a variety of minor operations, and for this purpose sheath knives with blades 9 to 12 in. long are convenient. The kinds of specimens most frequently collected are small foetuses and parts of larger ones, ovaries, food specimens, parasites and external scars, pathological growths, etc., and small pieces of tissue for histological examination. These can mostly be accommodated in glass tubes and jars ranging from 1 lb. to 5 lb. capacity, but ovaries and foetuses are best stored in large enamelled iron tanks, of which four or five were available for this purpose at the Biological Station.

The records and data obtained at the whaling station are entered in large log books or ledgers kept at the Biological Station. These are of three types. In the first, or general log book, a double page (reading right across the book) is kept for each whale, and here all details referring to external characters, blubber, parasites, food, reproductive organs, occurrence of foetuses, etc., are entered. The second, or measurements log, is kept for the measurements of bodily proportions. In the third, or foetus log,

a single page is kept for the details, including bodily measurements, external characters, etc., of each foetus.

Laboratory work in connection with the work at the whaling station (apart from the examination and analysis of the log-book data) consists in the detailed examination of such specimens as ovaries and foetuses, routine section cutting of pieces of testis, mammary gland and other tissues, and the examination of parasites, etc.

In the hydrological work undertaken at the Biological Station water samples from the ships were analysed for salinity and phosphate content, and occasionally for oxygen content. The methods used in this work are indicated on p. 213. In addition to the usual equipment required for work of this kind it is necessary to have an apparatus for the preparation of fairly large quantities of distilled water. It is also advisable to have a good supply of spare beakers, flasks and other glass ware. The chemical equipment of the laboratory includes apparatus for various other investigations to be carried out as opportunity arises: among these are the determination of the oil content of blubber and the analysis of whale's milk.

Work on the fauna of South Georgia consisted in shore collecting, trawling, plankton and hydrological work in East Cumberland Bay and some investigation of the local birds and seals. The gear most frequently used in Cumberland Bay has been an 8 ft. beam trawl towed from the launch, but owing to the great depth of the water (largely from 50 to 100 fathoms) this can only be used close to the shore. The fauna of Cumberland Bay, however, is very rich, and many interesting specimens may be obtained in this way. A small dredge was occasionally used, but better results were obtained with the beam trawl. The launch was fitted with a winder carrying 100 m. of 4 mm. wire, a small davit and a recording sheave. This outfit was used both for sounding and for working water bottles and vertical nets.

INDEX

Accommodation, 'Discovery', 155
  Marine Biological Station, 223
  'William Scoresby', 174
Accumulators, light, 164, 179
  heavy, 162, 178
Alcohol, *see* Spirit
Anaesthetics, 217
Analysis of water samples, 213, 229

Baillie rod, 210
Beam trawls, 206, 229
Biological laboratory, 'Discovery', 169
  'William Scoresby', 180
Birds, 149, 229
Bottles for preserving specimens, 220
  rack for, 170
Bottom sampling apparatus, 210
Bouin's fluid, 218
British Museum, 150
Buckets for plankton nets, 189
Budenberg depth gauge, 197
Bunker capacity, 'Discovery', 159
  'William Scoresby', 176

Cameras, 222
Chart-tracing table, 173
Chemical analysis of sea water, 213, 229
Chemical laboratory, 'Discovery', 172
Chloral hydrate, 217
Chronometers, 216
Clamps for wire ropes, 208
Closing mechanism for horizontal nets, 194, 201, 202
  for vertical nets, 192, 200
Collections, sorting of, 216
  work on, 150
Colour nomenclature, 222
Conical dredge, 207
Continuous plankton recorder, 189
Copper soap as a net preservative, 182
Crown Agents for the Colonies, assistance given by, 149

Deck machines, 163, 179
Depth gauges, 196
'Discovery', 145, 151
  accommodation, 155
  arrangements for scientific work, 160
  biological laboratory, 169
  boats, 156
  bunker capacity, 159
  chemical laboratory, 172
  construction, 152
  dimensions, 152
  machinery, 159
  original design, 152
  purchase, 154
  reconditioning, 155
  service with Hudson's Bay Co., 152
  sister keels, 160
Dredges, 207
Dredging, 148
Duboscq's fluid, 218
Dynamometer, 168

Echo-sounding apparatus, 157, 175, 180
Ekman-Nansen sounding rod, 211
Ekman reversing water bottle, 212
Elephant seals, 149
Equipment of ships, 151
Euphausians, 145, 201

Fair-leads, pedestal, 161, 178
  stern, 162
Fine-meshed nets on trawl, 205
Fine-meshed netting, 185, 186
Fish traps, 207
Fixation of specimens, 217
Formalin, 219
  as a fixative, 218
  storage on ships, 170, 180

Gauges to determine depth, 196
Grease for wire ropes, 167

Hand-lines, 208
Hand-nets, 208
Harpoons, 208
Hydrogen-ion concentration, 215
Hydrographic survey, 149, 215
Hydrological instruments, 210
  machines, 163, 179
  methods, 213
  work, 145, 146

Interdepartmental Committees, 144, 154
Investigations, objects of, 143

Jars, stoneware, 221

Kelvin sounding machine, 169, 180
Kelvin tube, 197
Knudsen full-speed water bottle, 213

Labels, 221
Laboratories, 'Discovery', 169, 172
  Marine Biological Station, 225
  'William Scoresby', 180
Laboratory methods, 216
Leads for plankton nets, 183, 184, 199
Log books, 222, 228
Lucas sounding machine, 168, 180, 215

Machines, for plankton and hydrographical work, 163, 179
  for sounding, 168, 169, 180
Marine Biological Station, 145, 223
Marking whales, 146, 208
Mechanism, for closing horizontal nets, 194, 201, 202
  for closing vertical nets, 192, 200
Menthol, 217

Migrations of whales, 146
Motor launch, 149, 226

Nansen-Pettersson water bottle, 212
Natural History Museum, 150
Nets, plankton, 181
  rectangular, 206
Netting for plankton nets, 185, 186
Nippers for wire ropes, 207

Objects of investigations, 143
Otter trawls, 204
Outboard platforms, 164
Oxygen, analysis for, 214

Pedestal fair-leads, 161, 178
Petersen young-fish trawl, 181, 188
Petrunkewitsch's fluid, 218
Phosphate, analysis for, 214
Photography, 222
Plankton, work on, 145, 146
  of deep water, 148
Plankton apparatus, 181
Plankton machines, 163, 179
Plankton net, N 50, 182
  N 70, 183
  N 100, 184
  N 200, 185
  N 450, 186
  TYF, 188
Plankton net rings, 182, 185, 186
Plankton nets, methods of handling, 199
  specifications, 182, 188
Plankton recorder, 189
Plankton samples, methods with, 217
Porpoises, preservation of, 221
Preservation of specimens, 218
Preservative for nets, 182

Recording sheaves, 166, 179
Rectangular nets, 206
Rings for plankton nets, 182, 185, 186
Ropes, *see* Wire ropes
Ross Sea, work in the, 148

Salinity, titrations for, 214
Samson posts, 164
Schaudinn's fluid, 218
Secchi disc, 213
Sheaves, recording, 166, 179
Ships used in investigations, 151
Silk for plankton nets, 182, 183
Sinkers for sounding, 210
Sketches of living animals, 222
'Sondeur Leger', 211
Sorting biological collections, 216
Sounding machine, Kelvin, 169, 180
  Lucas, 168, 180, 215
Sounding rods, 210
Sounding wire, 169
South Africa, work on whales in, 145, 148
South Georgia, biological station in, 223
  work on fauna of, 229
  work on whales in, 145, 228
South Sandwich Islands, work at, 148
South Shetlands, work on whales in, 148
Specifications of plankton nets, 182, 188
  of wire ropes, 167, 180
Spirit, 218
  storage on ships, 170, 180
Storage of specimens, 219
Stramin, 185
Stream-line leads, 199
Stream-line rings for plankton nets, 185, 186
Survey equipment, 215
Swing table, 169, 180
Swivels, 199, 203

Tanks for specimens, 221
Theodolites, 215
Thermograph, 156
Thermometers, 213
  unprotected, 198
Tide readings, 216
Tow-nets, *see* Plankton nets
Transparency disc, 213
Traps, 207
Trawling, 147, 148, 204, 229
Trawling winch, 160, 178
Trawls, 188, 204
Tubes for specimens, 172, 219

Water bottles, 212
Water samples, analysis of, 213, 229
  collection of, 213
Whale-marking, 146, 208
Whales, economic study of, 144
  investigations on, 145, 148, 228
  migrations of, 146
Whaling, history of, 143
  in Antarctic, 143
  regulations, 144
Whaling community, assistance given by, 149
'William Scoresby', 147, 174
  accommodation, 174
  arrangements for scientific work, 178
  boats, 176
  bunker capacity, 176
  construction, 174
  dimensions, 174
  machinery, 177
Winch, 160, 178
Winch-drum, auxiliary, 163
Wire for sounding, 169
Wire ropes, 167, 180
  damage to, 162
  strains on, 168
Wireless sets, 157, 175
Wireless time signals, 216

Young-fish trawl, 181, 188

PLATES VII—XVIII

Walker Sid ph.

Royal Research Ship 'Discovery'

PLATE VIII

R.R.S. 'DISCOVERY'

Profile and plan of Forecastle and Bridge Deck

1. Anchor davit
2. Deck lights and mushroom ventilators
3. Capstan
4. Sounding platform
5. Searchlight
6. Lucas sounding machine
7. Deep-water hydrological machine
8. Pedestal for small harpoon gun
9. Galley skylight
10. Windlass
11. Chain locker
12. Stores
13. Galley and kitchen
14. Galley companion
15. Skylight to kitchen
16. Crew-space companion
17. Skylight to crew space
18. Quarters of crew and petty officers
19. Chart house
20. Standard compass
21. Flag locker
22. Wireless accumulator box
23. Chart table
24. Engine-room telegraph
25. Laryngaphone to engine room
26. Deck cabin
27. Whaler
28. Wardroom entrance
29. Steering compass
30. Steam and hand steering gear
31. Deck laboratory
32. Bathroom
33. Wardroom companion
34. Freshwater tank
35. Wardroom skylight
36. Wardroom
37. Main bunker
38. Winch house and winch
39. Main boiler
40. Engine-room casing and skylight
41. Engine room
42. Norwegian pram
43. Dinghy
44. Lifeboat
45. Sail locker
46. Propeller well
47. Officers' water-closet
48. Armoury
49. Lamp locker
50. Rudder well

FORECASTLE AND BRIDGE DECK

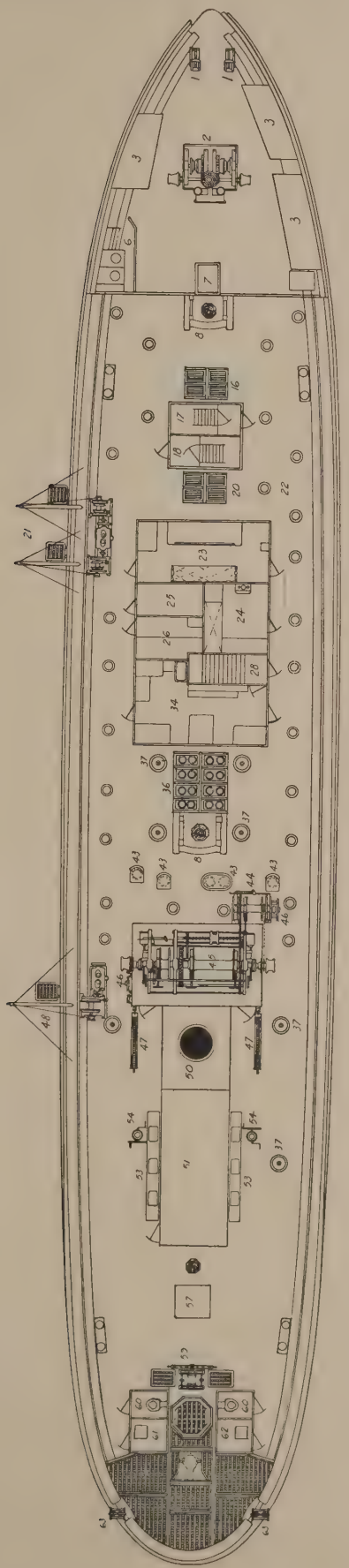
PROFILE

PLATE IX

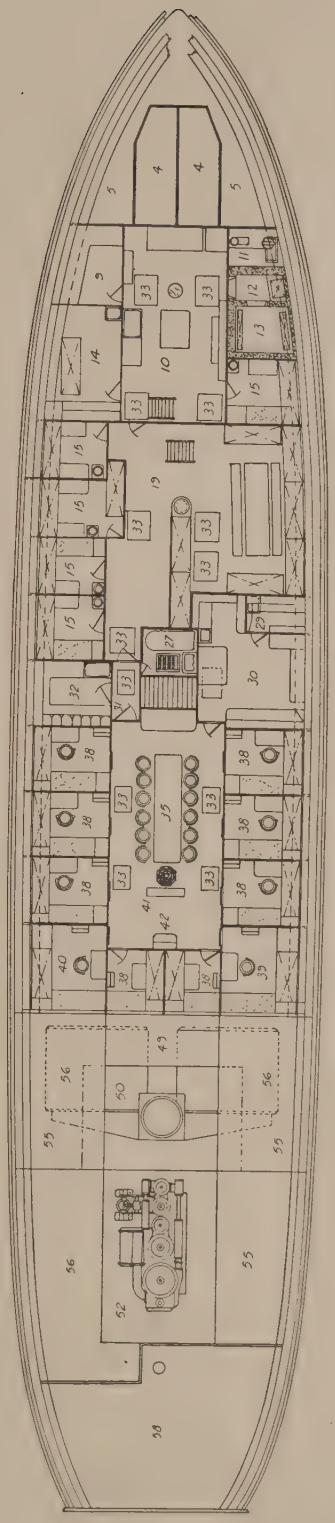
R.R.S. 'DISCOVERY'

Plans of Upper and Main Decks

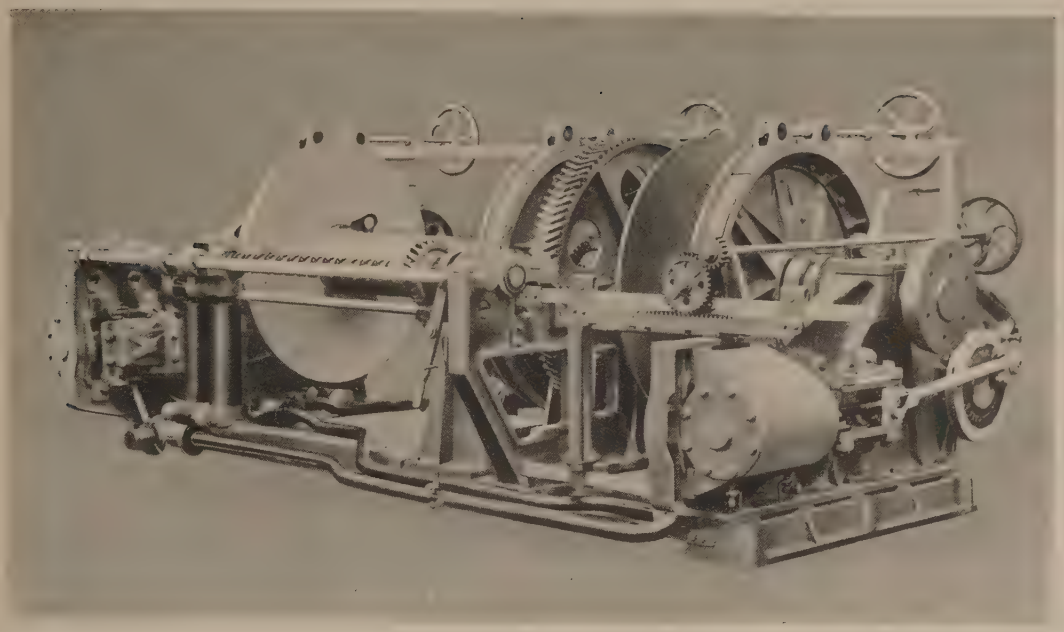
1. Bow stoppers for cables
2. Windlass
3. Lockers
4. Chain locker
5. Store
6. Crew's water-closet
7. Trunk to galley skylight
8. Fife rail round mast
9. Pantry store
10. Galley and kitchen
11. Refrigerator engine room
12. Refrigerator air-lock
13. Refrigerator cold chamber
14. Sick bay
15. Petty officers' cabin
16. Skylight to kitchen
17. Galley companion
18. Crew-space companion
19. Crew space
20. Skylight to crew space
21. Shallow water hydrographic machine with topping booms and platforms
22. Deck lights and mushroom ventilators
23. Chart house
24. Deck cabin
25. Survey store
26. Wireless cabin
27. Bathroom
28. Wardroom entrance
29. Dark room
30. Lower laboratory
31. Wardroom lobby
32. Wardroom pantry
33. Hatch to compartments below deck
34. Deck laboratory
35. Wardroom
36. Wardroom skylight
37. Coaling scuttle
38. Cabin
39. Captain's cabin
40. Cabin of Director of Research
41. Piano
42. Stove
43. Pedestal fair-lead for wire ropes
44. Winch auxiliary drum
45. Winch house and winch
46. Recording sheave
47. Accumulator spring
48. Plankton machine with davit and platform
49. Boiler room
50. Fiddley casing
51. Engine-room casing
52. Engine room
53. Ice tanks
54. Downton hand pump
55. Bunker
56. Workshop
57. Hatch to sail locker
58. Sail locker
59. Hand steering gear
60. Officers' water-closet
61. Armoury
62. Lamp locker
63. Stern fair-lead



UPPER DECK



MAIN DECK



Clarke, Chapman & Co. phot.

Fig. 1. R.R.S. 'Discovery'. Main winch.

E. H. Marshall phot.

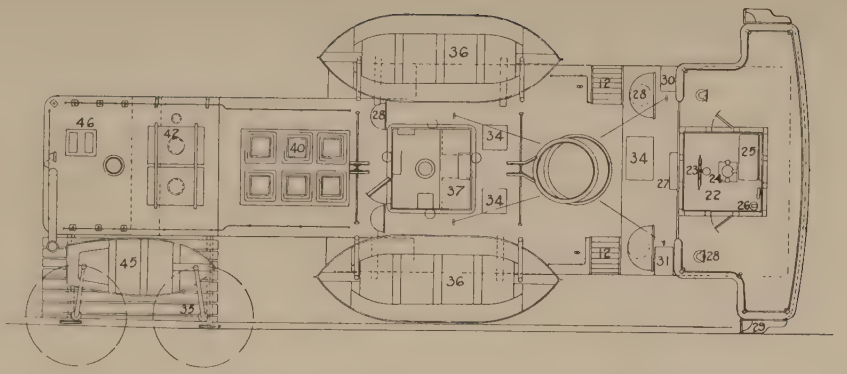
Fig. 2. R.R.S. 'Discovery'. View looking aft, showing winch house, auxiliary winch-drum, pedestal fair-leads and recording sheave.

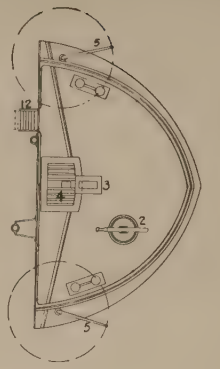
PLATE XV

R.S.S. 'WILLIAM SCORESBY'

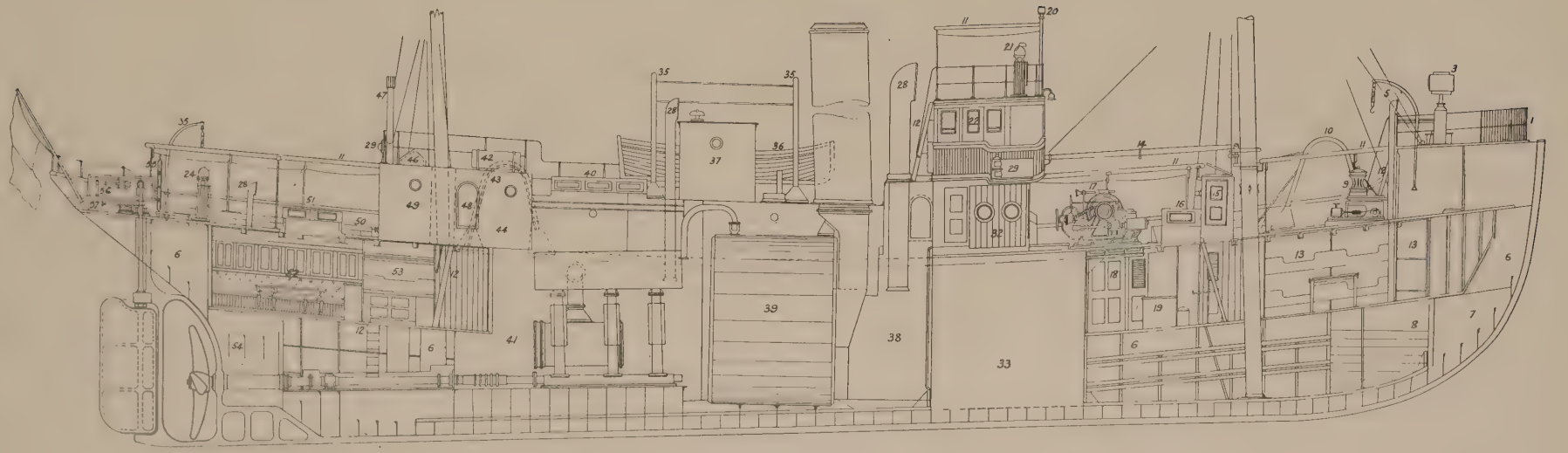
Profile and plan of Forecastle and Bridge Deck

1. Weather boarding as protection for whale marking
2. Light harpoon gun
3. Searchlight
4. Searchlight platform
5. Anchor davit
6. Store
7. Fore peak
8. Chain locker
9. Steam capstan
10. Fore gallows
11. Awning ridge pole
12. Ladder
13. Crew space
14. Derrick boom
15. Entrance to forward accommodation
16. Skylight
17. Trawling winch
18. Chart room
19. Chart table
20. Morse lamp
21. Standard compass
22. Wheel house
23. Steam steering wheel
24. Steering compass
25. Chart table
26. Engine-room telegraph
27. Flag locker
28. Ventilator
29. Navigation light
30. Spirit tank
31. Freshwater tank
32. Laboratory
33. Main bunker
34. Boiler room gratings
35. Davit
36. Lifeboat
37. Wireless room
38. Stokehold and wing bunkers
39. Boiler
40. Engine-room skylight
41. Engine room
42. Water tank
43. After gallows
44. Steering engine house
45. Dinghy
46. Galley skylight
47. Galley funnel
48. Passage giving access to after accommodation
49. Galley
50. Steering rod channels
51. Wardroom skylight
52. Wardroom
53. Cabin
54. After peak
55. Hand steering wheel
56. Hand steering gear
57. Quadrant





FORECASTLE AND BRIDGE DECK



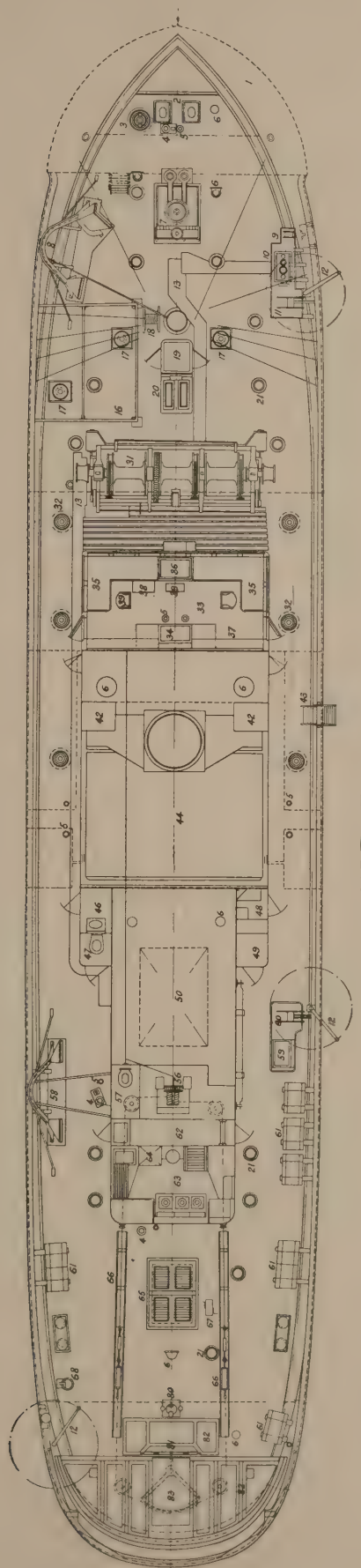
PROFILE

PLATE XVI

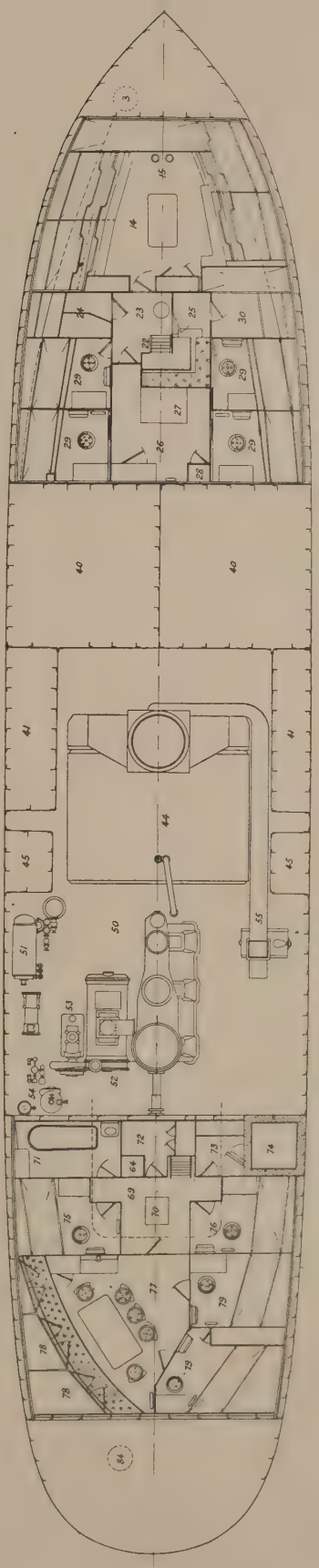
R.S.S. 'WILLIAM SCORESBY'

Plans of Upper and Lower Decks

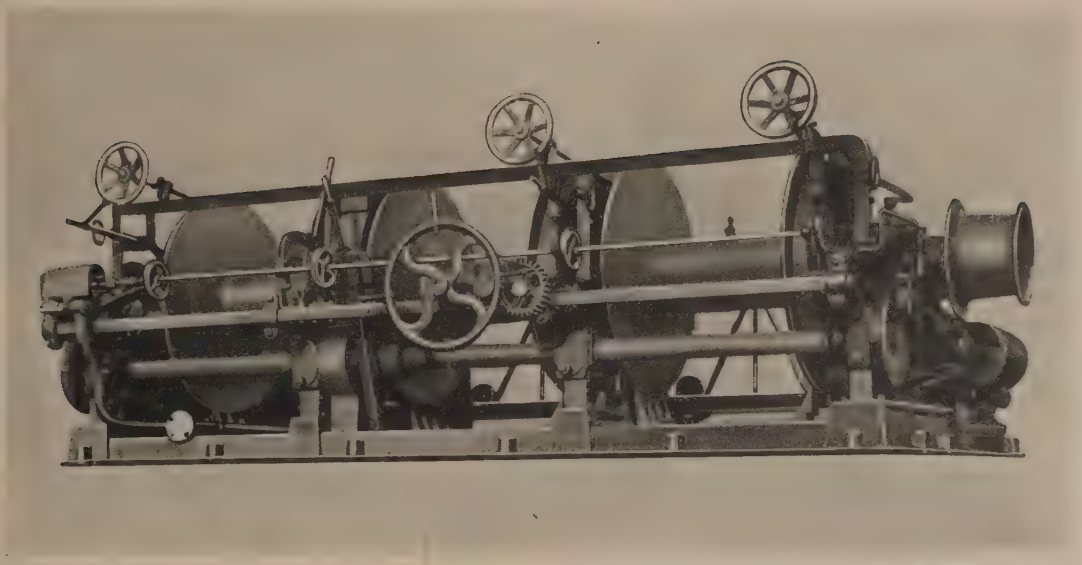
1. Flare of forecastle head
2. Hawse pipes
3. Scuttle to fore peak
4. Hand pump
5. Sounding pipe
6. Ventilator
7. Steam capstan
8. Fore gallows
9. Sounding machine
10. Engine coupled to sounding machine and hydrological drum
11. Hydrological drum
12. Davit
13. Steam pipe cover
14. Crew space
15. Chain pipes
16. Fish pound
17. Pedestal fair-lead
18. Drum for mooring wire
19. Companion to forward accommodation
20. Skylight
21. Deck lights
22. Ladder
23. Lobby
24. Scientific store
25. Petty officers' mess
26. Chart room
27. Chart table
28. Medicine chest
29. Cabin
30. Pantry
31. Trawling winch
32. Manhole door to bunker
33. Laboratory
34. Sink
35. Bench
36. Swing table
37. Bottle rack
38. Sliding desk
39. Seat
40. Main bunker
41. Wing bunker
42. Recess for ladder to bridge
43. Accommodation ladder
44. Boiler
45. Feed water tank
46. Crew's wash house
47. Crew's water-closet
48. Lamp room
49. Deck store
50. Engine room
51. Feed heater
52. Condenser
53. Main circulator
54. Evaporator and distiller
55. Forced draught fan and engine
56. Steering engine
57. Officers' water-closet
58. After gallows
59. Plankton engine
60. Plankton reel
61. Specimen tanks
62. Passage giving access to after accommodation
63. Galley
64. Lift
65. Skylight to wardroom
66. Steering rod channel
67. Kelvin sounding machine
68. Towing ring plate
69. Wardroom lobby
70. Hatch to store
71. Bathroom
72. Pantry
73. Store room
74. Cold store
75. Captain's cabin
76. Cabin of senior scientific officer
77. Wardroom
78. Cupboards
79. Cabin
80. Hand steering compass
81. Hand steering wheel
82. Grating support
83. Quadrant
84. Scuttle to after peak



UPPER DECK

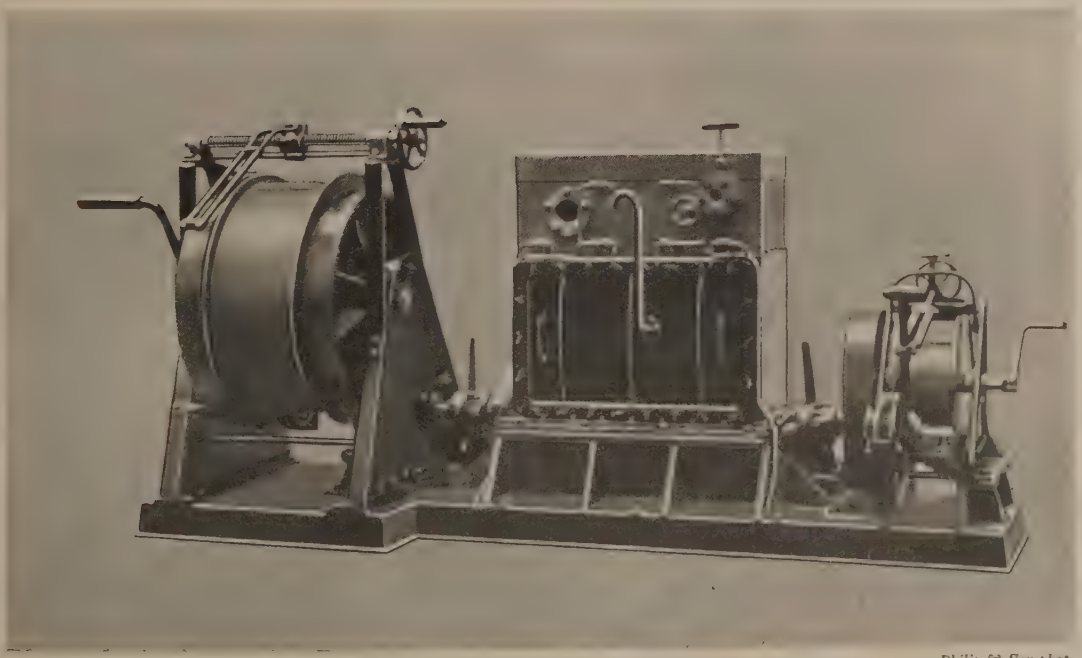


LOWER DECK



Strath Engineering Works phot.

Fig. 1. R.S.S. 'William Scoresby'. Three-barrelled trawling winch.



Philip & Son phot.

Fig. 2. R.S.S. 'William Scoresby'. Drum of wire for hydrological work (left) and Lucas sounding machine (right) coupled to the same engine.

N. A. Mackintosh phot.

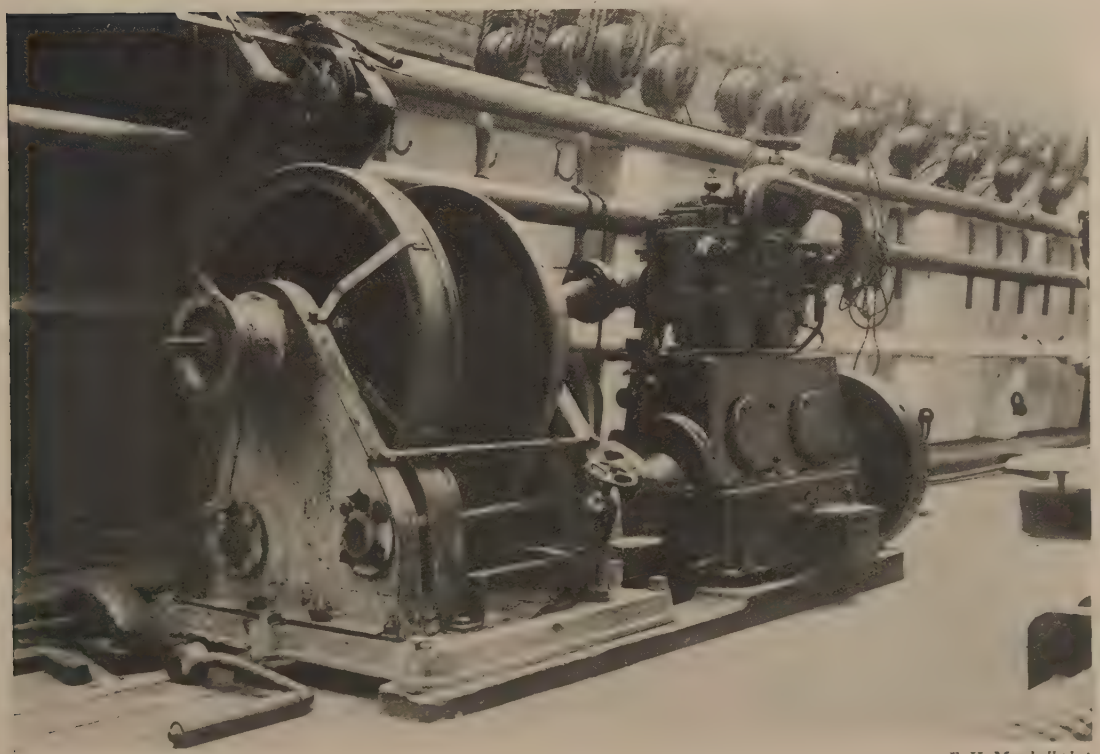
Fig. 1. The Marine Biological Station, South Georgia.

N. A. Mackintosh phot.

Fig. 2. Part of the Laboratory of the Marine Biological Station, South Georgia.

S. Kemp phot.

Fig. 1. R.R.S. 'Discovery'. Plankton machine.

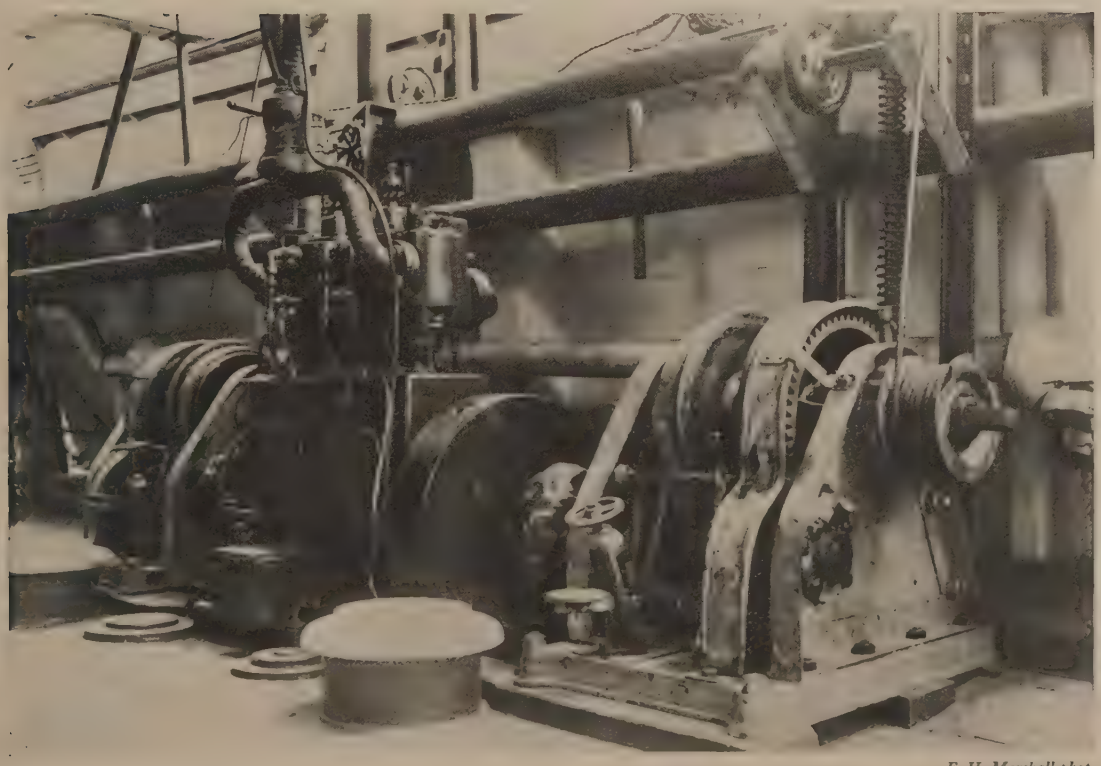


E. H. Marshall phot.

Fig. 2. R.R.S. 'Discovery'. Engine of plankton machine.

S. Kemp phot.

Fig. 1. R.R.S. 'Discovery'. Shallow water hydrological machine.



E. H. Marshall phot.

Fig. 2. R.R.S. 'Discovery'. Engine of shallow water hydrological machine.

E. H. Marshall phot.

Fig. 1. R.R.S. 'Discovery'. View on forecastle head, looking aft, showing Lucas sounding machine on right, and deep-water hydrological machine on left.

E. H. Marshall phot.

Fig. 2. R.R.S. 'Discovery'. View on forecastle head showing anchor davit rigged with accumulator and recording sheave for deep-water hydrological work.

A. Saunders phot.

The Research Steamship 'William Scoresby'.

[*Discovery Reports. Vol. I, pp. 233–256, Plates XIX–XXIV, June* 1929.]

THE NATURAL HISTORY OF THE ELEPHANT SEAL

WITH NOTES ON OTHER SEALS FOUND AT SOUTH GEORGIA

By
L. HARRISON MATTHEWS, M.A.

CONTENTS

The Natural History of the Elephant Seal, *Mirounga leonina*, Linn. . *page* 235

Bibliography of the Elephant Seal 249

Notes on other Seals found at South Georgia 252

Plates XIX to XXIV . . . . . *following page* 255

THE NATURAL HISTORY OF THE ELEPHANT SEAL

WITH NOTES ON OTHER SEALS FOUND AT SOUTH GEORGIA

By L. Harrison Matthews, M.A.

(Plates XIX–XXIV)

THE NATURAL HISTORY OF THE ELEPHANT SEAL, *MIROUNGA LEONINA*, Linn.

ELEPHANT seal, the largest of their race, in countless thousands make the shores of South Georgia their home during the southern summer. They are away at sea all the winter, and at the approach of spring they commence to haul out to breed on the beaches, where they congregate in rookeries, staying ashore for months on end (Plate XIX, figs. 1, 2). They are exceedingly slothful and unwieldy animals, the bulls being very much larger than the cows, and provided with a fleshy inflatable proboscis which hangs down over the mouth. The cows have no proboscis, but they are able to inflate the nostrils, producing a swelling and puckering of the skin of the nose. Elephant seals are polygamous, each bull gathering a harem of cows, which he jealously guards from his rivals. After the breeding season is over they return to the sea for several weeks, and then haul out again and spend two months on the land whilst the hair is shed and a new coat is grown.

Distribution. Beneath the skin of the elephant seal there is a layer of blubber so thick that when moving on the land "the whole body trembles like a bag of jelly." It is the presence of this blubber that has caused the elephant seal to be hunted nearly to extinction in many of its former haunts. At the end of the eighteenth century it was found on the coasts of Patagonia, Tierra del Fuego, and southern Chile, and was plentiful on the Falkland Islands, the South Shetland and South Orkney Islands, and at South Georgia. Further east it occurred in thousands at Tristan da Cunha and Gough Islands, Marion and Prince Edward Islands, the Crozet Islands, Kerguelen and Heard Islands and Macquarie Island, and it has also been seen on the coasts of South Africa. An allied race was formerly abundant on the coasts of California and Western Mexico and the nearby islands: a few still remain on Guadalupe Island. By the indiscriminate slaughter of young and old they have been exterminated or reduced to a mere remnant in most of these places, but they are still found in numbers sufficient for hunting in South Georgia, Kerguelen, Heard and Macquarie Islands. At South Georgia the hunting was formerly so intense that by 1885 elephant seals were practically extinct. After this date the island was not worked for some years, so that the

seal increased in numbers till at the present time they are probably as numerous as ever. The hunting is now regulated by Government, so that there is no risk of them ever being exterminated again.

Annual "haul out". Seal commence to haul out on to the beaches in small numbers during the last part of August, but the times for the various parts of the island vary considerably. For example, in 1925 the seal had hauled out on the beaches from Cumberland Bay to Cape Disappointment and many pups were born by the end of August, but on the south side of the island hardly any were out until the first week in September.

From the middle of August onwards the cows haul out on the beaches and lie together in small parties awaiting the birth of their pups. These are born about a week after the mother hauls out, and the groups of cows form the beginning of the harems that the bulls collect later on. As soon as the cows arrive the bulls commence to haul out, though in smaller numbers. At first they lie by themselves on the beaches, keeping apart from the cows (Plate XIX, fig. 1), but soon after the first pups are born they join the cows, many of which have not yet given birth to their pups.

Birth of the Pups. The pups are born from the last week in August to the end of September and some even in October, so that the season lasts for six weeks or more. Most of the late pups are first ones, their mothers having been impregnated for the first time late in the last season. The virgin cows haul out much later than the mothers and join the harems already formed on the beaches. Twins were not observed, one pup to each cow being the rule. The cows are not impregnated at once after the pups are born, though the bulls attempt to cover them. The cow will not take the bull until a week or ten days after the birth of the pup.

At birth the pups are covered with a black woolly coat (Plate XX, fig. 1). This is shed, the change commencing about a fortnight after birth, and becoming complete in about five weeks. The black coat is first shed on the back, then on the belly and last on the head and face. The coat which is exposed when the black coat is shed is of soft hair, grey in colour, and lasts until the moult of the following season.

The umbilical cord, which is black and 2 ft. long, is sloughed off about three days after birth. The piece attached to the new-born pup is from 12 to 18 in. long (Plate XX, fig. 1). It was not ascertained if the cord is bitten asunder by the mother at birth, or if it is merely broken, but it is fair to assume that it is broken, first because of the ragged appearance presented by the free end, and secondly because the teeth of the mothers are capable of being used for seizing objects but not for cutting them. The foetal membranes and large fleshy placentas are a conspicuous feature of the rookeries at the beginning of the season when the pups are being born. Much of this rubbish is eaten by the Gulls, Skuas, Giant Petrels and Sheathbills. A discharge of mucus, at first discoloured with blood, continues to ooze from the vulvas of the cows for several days after the birth of the pups.

Suckling. In giving suck the cow lies on her side, and the pup sucks the area surrounding the teat, which is shortly protruded (Plate XX, fig. 2). The pups suck for

five to ten minutes at a time, and must swallow a considerable amount of air as they make plenty of noise during the process. When hungry, the pup, lying alongside the mother, commences barking and nuzzling round the body of the mother in a feeble way until she turns on her side, when it soon finds the teats. There are two teats, one on each side of the middle line about one-quarter of the animal's length from the tail; they are kept retracted when the pup is not suckling. The flow of milk is small, as is shown by the long fine jets which squirt from the teat for a moment when the pup stops sucking. The pup takes milk from one teat only at each feed, when small usually from the lower one as the cow lies on her side, but when older from either indifferently.

Pups. At birth the cry of the pups is a shrill staccato barking, very much like that of a dog puppy, but this gradually changes, so that by the time they are a month old the cry is very much deeper and harsher. At this age they start to get the voice characteristic of the adult, and when excited raise up their heads and attempt to roar like their parents; but at first they are able to produce nothing but a hissing sound in the throat. When slightly older they can produce a rattle in the throat, which gradually deepens to the proper roar as they get larger, though even at the end of the season it is still comparatively feeble.

The pups grow very rapidly. At birth they are about 3 ft. long and at the end of the first month they are about 4 ft. long. The greatest increase, however, is in girth. At birth they are thin and have little blubber on them but the thickness of this very rapidly increases so that, by the time the coat changes, they are nearly as broad as they are long.

The pups do not have any very definite time for leaving their mothers, but roughly it is about the time that the coat change is half completed. When they leave them they congregate in batches of as many as twenty or more; many join these bands before the coat change is complete, yet on the other hand a number have been observed still suckling after the coat change was complete. When they leave the mothers they do not immediately take to the water but lie around sleeping on the beaches or playing in the streams of fresh water or in the shallow water near the shore (Plate XXI, fig. 2). By January they will take to the water much more readily if disturbed than when they are younger. Once they have taken to playing in the shallow water they soon learn to take longer excursions into deeper water, and it is then that they start feeding on their own account. From the time that they leave the mothers until they take to the water—about six weeks—they do not feed, but exist on their enormously thick blubber. At the end of December they are very noticeably thinner than they are when the coat is changed, being more fusiform and less nearly globular in shape. They do not finally leave the beaches and take to a pelagic life for some time longer. During the early part of the year they are continually hauling out to sleep, and finally leave in April and May when the adults also go.

Harems: Pugnacity of the Bulls. The harems are formed by the cows hauling out in bunches to give birth to their pups, as mentioned above, and later these groups are annexed by the bulls. When a number of harems lie close to each other on the beach

they are collectively termed a "rookery" (Plate XIX, fig. 2). The number of cows in the harem depends on the strength and activity of the bull and his ability to keep away other bulls. As many as thirty cows have been observed in one harem but a smaller number is the rule, from a dozen to twenty, though some bulls have to content themselves with two or three only (Plate XXI, fig. 1[1]). The bulls in adjacent harems are continually fighting over the possession of the cows, and driving away the bachelor bulls which lie on the beach round the edge of the harem, and also loiter around in the water alongside. If one of these bulls outside the harem makes a move, the harem bull immediately raises up his head, and if the bachelor approaches his harem he starts roaring. In roaring the bull throws back the head and inflates the proboscis and, with the mouth widely open, produces a succession of loud expiratory bellows in the throat (Plate XXI, fig. 3). After three or four long ones, he gives a number of shorter ones and usually finishes off with another long one. The roar is not inspiratory, as has been stated by some writers, but expiratory. Between each roar there is a pause for breath, and during the roaring particles of saliva and phlegm can be seen to be forcibly ejected from the throat.

When the harem bull starts roaring at a bachelor bull, if the latter is a small one, he usually takes this as a warning and edges away, but if he is a big one he usually answers back, challenging the harem bull to fight, frequently approaching closer. This sets the harem bull beside himself with fury and immediately he blindly rushes at his rival in a direct line over his cows and pups. If this does not start the other in flight a fight ensues. Approaching each other closely face to face, each bull rears up as far as he can on the hind third of the body, and, with the mouth wide open and the proboscis inflated, falls forward against his rival, endeavouring to lacerate him with his upper canine teeth (Plate XXII, figs. 2, 3). They do not bite each other when fighting in this way, and most of the wounds are received on the head and sides of the neck. If, however, one of them makes an unsuccessful lunge and falls forward, the other wallops down on top of him with all his weight and bites his neck or back, sometimes tearing out a lump of skin and blubber nearly a foot square. If this happens the fight finishes at once, the vanquished making off as fast as he can, pursued for a short distance by the victor. If no bad wounds are given these fights do not last longer than four or five minutes; if the harem bull gets in a few good blows the other soon gives up.

When trying to drive a human intruder from the neighbourhood of the rookery, if roaring does not effect his purpose, the harem bull makes for the cause of his annoyance with all possible speed and regardless of obstacles. If he is in the middle of his harem he goes lolloping over his cows and pups, in spite of the disturbance that this causes, and it is astonishing that the pups manage to survive such rough treatment. One would expect to find them completely flattened by the passage of a large bull over them, yet one rarely sees them injured in this way. The bull, however, does not dare to leave his

[1] I am indebted to Lady Shackleton for permission to reproduce this photograph and those shown in Plate XXIII, figs. 1 and 2. They were taken at South Georgia during the Shackleton Antarctic Expedition of 1914–17.

harem unguarded and will only pursue the intruder a little way. When he wishes to return to the harem he stops by throwing forward his weight, without raising the fore part of the body on the fore flippers as he does in normal progression, so that he pitches forward on to his chest, raising the back part of the body and hind flippers high into the air. He then raises the fore quarters and swings round on the middle part of the body with both ends raised up in the air at the same time, and returns to his cows. He goes through the same process in chasing a rival bull, and will also suddenly swing round on the middle of the belly in this peculiar way to face an intruder if he is disturbed when asleep. If the disturbance is slight and behind him, to save himself the trouble of swinging round unnecessarily, he raises his head vertically and bends it back so far that he looks along his own back at the cause of his uneasiness. Cows and small bulls, if disturbed, will bite on a stick presented to them and wrench it forcibly from the hands; no doubt the big bulls would do so as well. The bachelor bulls fight considerably among themselves in the breeding season, when they are hanging round the outskirts of the rookeries. The fights between the bachelor bulls frequently last on and off for a long time, two of them lying near each other on the beach being engaged in bouts of fighting all day long.

The bulls very rarely, if ever, give each other mortal injuries; at least no case of this has ever come to the notice of the writer, but they often wound each other severely. Most of the wounds are lacerations and cuts on the sides of the neck, so that the skin of this region in an old bull becomes entirely hairless and covered with thick wrinkled and scarred skin (Plate XXI, fig. 1; Plate XXII, fig. 1; Plate XXIII, figs. 1, 2). Lacerations of the proboscis are also frequent, sometimes, though not commonly, the greater part of it is completely torn away; the usual wounds are cuts in the front overhanging portion, going right through into the nares. Wounds caused by biting are commonest on the back of the neck and body. The eyes, also, are commonly injured: in fighting, the canine tooth of one scratches the surface of the eyeball of the other sufficiently to cause an inflammation leading to a conjunctivitis. When the wound heals the conjunctiva becomes white and opaque. One-eyed seals with this injury are to be seen in all the big rookeries. Sometimes the eyes are completely torn out. It is noticeable that the body wounds do not heal readily and nearly always suppurate badly. This, in the opinion of the writer, is due to the dirty state of the rookeries and the indifference that the seal have to wallowing in filth.

The impression one gets from watching the elephant seal is that they would be extremely dangerous if they could move with any degree of agility on the land: it is only their cumbersome unwieldiness that makes them harmless.

Breeding Habits. The bulls are peculiarly jealous if they are disturbed in the rookery. When they return to their harem, after their warlike demonstration to the intruder, they invariably start pairing with their cows. In the large harems the bachelor bulls on the edges poach the outlying cows while the harem bull's attention is engaged with another cow. But the harem bull keeps a watchful eye on them and does not leave them long in peace as soon as he has finished with his own cow, though until he has,

he will not leave her to drive the other away, merely contenting himself with roaring persistently at him.

From the above it will be seen that the cows take any bull that offers and show no fidelity to the harem bull. The bulls have an extremely strong sexual instinct and appear to be able to cover any number of cows in succession. In pairing, the bull embraces the cow with one of his fore flippers and lying on one side draws her to him. He takes hold by biting her neck and then brings his hind quarters round to the cow's tail and protrudes his penis. The process lasts from ten to fifteen minutes during which they both lie quiescent. This habit of the bull biting the cow is the cause of the many white spot-like scars to be seen on the necks of the cows (Plate XXI, fig. 1).

The period of gestation is eleven months.

Towards the end of the pairing season when the pups have changed their coats and are leaving their mothers, occasional bachelor bulls that have been unable to get a harem of their own persecute the pups and attempt to pair with them. The writer thinks that pups are sometimes killed by this misplaced affection. Though none were ever actually seen to be killed, dead pups have been found that showed no definite cause of death, but appeared to have been suffocated by the weight of a bull practising this habit.

Cows. The cows in the harems are very quarrelsome amongst themselves. If, in moving, one of them disturbs another they snap at each other, striking forwards and downwards with the upper canines after the manner of the bulls in fighting, though they do not rear up on the back part of the body so much as the bulls. They do not, however, have pitched battles like the bulls, these bouts of quarrelling being merely displays of bad temper. If they are disturbed by the presence of a human visitor to the rookery and are closely approached they rear up the front part of the body, supporting it with their fore flippers, and, opening the mouth widely, produce a harsh roaring noise in the back of the throat, and lunge out towards the cause of their annoyance. The voice of the cows when angry is similar to that of the bulls, but is not nearly so deep. When they have their pups the cows also produce another sound that is very characteristic of the rookeries at this period. It is a long drawn-out falsetto sound, almost a whine, produced with the head thrown up and the mouth widely open (Plate XXIV, fig. 2). This cry is used in calling to the young pups and if the rookery is disturbed so that the pups get separated from the cows an amazing volume of sound is produced until the mothers have found their young ones again.

After the pups are born the virgin cows begin to haul out and join the rookeries, most of them arriving in the last half of October and in the beginning of November. It is easy to recognize them in the rookeries by their small size and the absence of old scars on their necks. It is quite certain that none of the adult cows escapes impregnation, as there are too many spare bulls on the beaches for this to happen.

Growth. Elephant seal take two years to become adult. At the end of the first year they are $5\frac{1}{2}$ to $6\frac{1}{2}$ ft. long, judging from the few examples seen that had been branded, and by the numbers of this size, male and female, that are to be seen on the

beaches away from the harems. At the end of the second year the cows are impregnated, being then from $7\frac{1}{2}$ to $8\frac{1}{2}$ ft. long. They continue growing after this and by the time that they are three years old, when they have their first pups, they are 9 to 10 ft. in length. The bulls at the end of their second year are 12 to 14 ft. long and have only a slight development of the proboscis. At this age they would breed, were they not kept away from the harems by the older and stronger bulls. After this age they grow gradually, up to 18 or 20 ft. long, with increasing girth and development of the proboscis (Plate XXIII, fig. 2). The writer believes that the bulls go on growing at least until they are five years old but he has no definite data to support this opinion.

Food. The writer has examined the stomachs of a large series of elephant seal to ascertain what their food is. The stomachs contain a large quantity—up to two gallons—of yellow watery fluid, usually pale but sometimes deep in colour, and several pounds of sand and shingle. In addition all the stomachs are heavily infected with nematode worms. In 35 per cent of the stomachs examined cephalopod beaks[1], some of large size, were found, though no soft parts were seen, and this is not to be wondered at, as all these specimens were killed in the rookeries where they had been fasting. No trace of any other food was found. Wilson, in the *Report of the National Antarctic Expedition of* 1901–1904, stated that he found no food in the stomachs of his specimens, but pointed out that the diet probably consisted of cephalopods, from a consideration of the dentition. It is probable that cephalopods are the sole food of the animal, and when one considers the number of seals on South Georgia and the large amount of food that they must consume to get so well covered with blubber, one realizes that the waters surrounding the island must be teeming with these molluscs. That this is so is also shown by an examination of the stomachs of the Albatross, Mollymauks, Cape Hens and Macaroni Penguins from the same locality, all of which are full of squid beaks. The squid are certainly there, and at times, if not always, near the surface, though no naturalist has yet invented gear which will catch them and prove their presence directly.

The writer has been unable to ascertain how the sand and shingle gets introduced into the stomachs of the elephant seal. It is most probable that the sand is deliberately swallowed, as it can be taken as certain that it is not swallowed with the food. A small amount may be swallowed accidentally when the seal are in the rookeries, but this would not account for such large quantities. Other species of seal are known constantly to have in their stomachs stones which are deliberately swallowed, so it is a fair assumption that the elephant seal get theirs in the same way, though no actual instance of the deliberate swallowing of sand and shingle has been observed. Sand was not only found in the stomachs of the adults, but also in the stomach of a young one that had only just completed the coat change and had not yet left the beach. Thus, if it is swallowed deliberately, the habit is a well-established instinct, since this young one had not yet

[1] Mr G. C. Robson has kindly examined these beaks and is of the opinion that they belong to a species of the family Architeuthidae. Any more precise identification is unfortunately impossible.

started independent feeding and the sand would therefore be quite useless to it. The function of the sand and shingle is presumably to triturate the food, which must be swallowed whole, as the teeth are only adapted for seizing and not for masticating.

First return to Sea. When the seal are in the rookeries they do not feed. During the breeding season the cows and bulls fast for two months, and then, when the harems break up, they go to sea in December and return to land in January and February to change their coats. They stop ashore for another six weeks to two months and then return to the water and do not haul out again until the next breeding season. It must not be supposed, however, that all the seal arrive and depart with any regularity. After the first haul out in the spring they all return to the water for a period after breeding, but the times vary individually. There are always adult seal of both sexes to be seen on the beaches right through the summer in addition to the young ones, though the above dates are correct for the majority. The bulls remain ashore later than the cows: by the first week in April very few cows are left, though there are plenty of bulls until the end of the month. The cows, however, haul out earlier than the bulls, arriving in January and early February, whilst the bulls do not come ashore till the latter part of February and the beginning of March.

Annual Moult. The moult occurs after the breeding season and after the seal have been to sea for a period. The actual time of the moult varies individually, but it is earlier with the cows and yearlings than with the bulls. With the former it starts about halfway through January and is in full swing during February. With the bulls it starts in February and lasts to the end of March. The process from the commencement of the shedding until the new coat is complete lasts from a month to five or six weeks. The hair comes off in patches, first on the back and shoulders, last on the belly, face and flippers. The patches peel off in sheets, the hair being held together by a layer of the epidermis which is shed, taking the hair with it (Plate XXIII, figs 1, 2). The hair projects about a quarter of an inch on the outside, and about one-eighth of an inch on the inside of this layer of epidermis when shed. In the cows and yearlings and the smaller bulls the new hair, soft, short and closely adpressed to the skin, is exposed when the old coat is shed, but in the older bulls the patches left where the old hair comes off are at first quite naked (Plate XXIII, fig. 2), and the new hair does not start sprouting for a week or ten days. During the shedding of the coat the seal get very out of condition and the thickness of the blubber is much diminished. In some cases also, the gums become congested and bleed at this season.

When they are shedding their coats the seal like to lie in wallows, which they make by lying and rolling in the pools of water amongst the clumps of tussac grass. They quickly produce a swampy quagmire, and as many as thirty or forty are sometimes to be seen lying closely packed together in these mud baths. The cows and bulls tend to keep apart at this time, each wallow being usually, though not invariably, packed with seal of the same sex. The writer has seen these wallows so deep in mud that only the heads of the seal were above the surface, and actually came across one instance in which the seal was completely immersed and was breathing through a hole about

9 in. deep that its breath kept open in the thick sticky mud. They still lie in the wallows and on the beaches after the moult is complete and are often to be seen bathing in the shallow water near the shore.

Final return to Sea. There is no definite time for all the elephant seal to return to the sea. The cows and young ones start leaving in March and are all gone by the middle of April, while the bulls follow them later, so that the beaches are practically deserted by May. Occasional seal, especially pups of the preceding season, haul out during the winter, but they do not stop ashore long. Whether the majority stay near the land during the winter or migrate far it is impossible to state. Occasionally adults are seen at sea in the neighbourhood of the island in the winter, but not nearly so frequently as in the summer. The National Antarctic Expedition of 1901–1904 found one at Cape Royds on the Antarctic continent in Lat. 77° 40′ S., more than a thousand miles from the nearest place where they are known to breed, and one was killed on the coast of South Africa during the visit of the 'Discovery' there in 1926. It is evident, therefore, that they can travel long distances at sea.

Mortality and Natural Enemies. The mortality of seals ashore is low. No fatal epidemics, such as the Uncinaria disease which afflicts the breeding rookeries of the northern fur seal, occur. A few dead pups are to be seen in most large rookeries; they are usually very young ones killed by being rolled on by one of the cows lying alongside the mother, or by the bull. Occasionally the very young pups die of starvation in the large rookeries, through wandering away from their mothers, for they are singularly unintelligent in finding their way back to them from even a short distance, and the cows are equally ineffective in finding their pups. The pups often lie so long in one spot that the heat of their bodies melts away the snow to such an extent that they sink down below the general level of the rookery (Plate XXIV, fig. 1). It sometimes happens when the season is late, so that the snow lies deep well into the spring, that they sink so far down that they cannot get out again to reach their mothers and are thus lost. It is extremely seldom that adult seals are found dead ashore. Several decomposed carcasses were observed, but only once was a fresh one seen, when circumstances did not allow of an examination as to the cause of death. No signs of disease were seen amongst them: two were seen with tumours in the blubber formed from old wounds; as stated above, their wounds often suppurate badly. No external skin parasites were found. The Killer Whale is the only natural enemy of the elephant seal of which the writer is aware. One of the gunners at Leith Harbour Whaling Station shot a killer whale off South Georgia in November 1926, and when it was struck by the harpoon it vomited up the heart, liver and a piece of blubber, about 4 ft. by 2 ft. in size, of an elephant seal. This gunner also told the writer he had previously seen killers attack elephant seal and cut them in two at one bite.

Branding Experiments. Some hundreds of pups have been branded yearly from 1921 to 1925, by the Magistrate's staff, but very few have been seen again. The island is divided into four divisions for purposes of administrating the sealing licences, and the brand used on the seal shows the division, and the year in which they are marked.

It has been found that the best time for branding is the beginning of November when most of the pups are completing the shedding of their first black woolly coat, and are leaving their mothers and congregating in small flocks by themselves on the beaches. If the branding is left till later the pups are so big that overcoming their struggles wastes a lot of time. They stand the branding very well and appear to be extremely insensible to pain. Only three branded seal have been seen, all in 1925, and all had been branded in the previous season. One hauled out on King Edward Point, Cumberland Bay, early in November 1925, bearing the brand of No. 3 Division, which includes Cumberland Bay. It was a female, $5\frac{1}{2}$ ft. long. The scar of the brand was incompletely healed, and was suppurating slightly at the angles of the figure "3". This was the only one seen by the writer.

Sand throwing Habit. When lying on the beach elephant seal have a peculiar habit of throwing sand and shingle on to their backs. It is, in fact, not only a habit but an instinct, as the very young pups cover themselves as do the adults (Plate XXI, fig. 1). They throw the sand up by bringing the fore flipper of one side round so that the tip is directed nearly forward, and then suddenly sweeping it round sideways and backwards, scooping up with the palmar surface a load of sand which is thrown upwards with considerable force; so much so that frequently most of it falls on the beach on the other side of the seal. It has been stated that they do this to keep off the direct rays of the sun, but this cannot be so, as they do it just as much on dull days as when the sun is shining. In the writer's opinion it is to keep the skin moist that the habit has been developed. The skin of the seal is always wet when it is in the water, as the hair is short and encloses no layer of air, so that, no doubt, a feeling of irritation is produced if the skin dries when the seal is on the beach. The eyes, too, appear to be irritated by the air when the seal leaves the water, for there is a copious secretion of tears which stream down the sides of the face and produce large wet patches round the eyes (Plate XXI, fig. 1; Plate XXIII, fig. 2).

An unexpected mobility of the fore limb is shown in thus reaching forward to scoop up sand, and it is further displayed when the seal use the limb for scratching themselves. The digits are provided with well-formed nails, and they can bring the fore flipper forward so as to scratch the chin or top of the head, or to wipe the nose with the back of it, and can bring it back so as to scratch the belly, hind flippers or back. The hind flippers, too, although unprovided with functional nails, are used for scratching each other, the hind portion of the body being raised in the air and the flippers vigorously rubbed together. When stretching themselves the hind flippers are also brought into play, the plantar surfaces being brought together and the webs widely stretched like a fan.

Breathing. When sleeping or lying undisturbed the breathing of the elephant seal is characteristic. Inspiration is deep, and then the nostrils are closed and the breath held for an average of forty seconds. This is followed by a rapid forcible expiration. Every few expirations one more forcible than usual is given, producing a loud snort, so that after the seal have been out of the water for some time their muzzles become

very dirty with the expelled mucus. They also have a habit of keeping one nostril tightly closed and breathing only with the other (Plate XXIII, fig. 3).

Progress on Land. When travelling on the land elephant seal carry the head well raised, and always use the fore flippers, while the hind flippers are trailed uselessly on the ground. The fore flippers are spread out at the side with the palms on the ground and the fore part of the body is raised by them and hitched forward. At the same time that the fore part is being raised, the back is curved upwards, so that the hind flippers are drawn up slightly nearer, and as the front flippers hitch forward, the back is straightened, and the body is pushed forward from the pelvic region. When hurried, on a good surface, such as hard level snow, a big bull can do about five miles an hour —a man has to run to keep up with him—but he very soon becomes exhausted. When undisturbed they move forwards a few steps and then drop the head down and rest for a little, then move a few yards further and rest again, and so on. Nevertheless, they wander for considerable distances from the shore. In King Haakon Bay and the Bay of Isles the writer has seen them over a half a mile from the beach, and in spite of their unwieldiness they sometimes climb up on the tussac-covered hills, over uneven ground, to a height of 60 or 70 ft.

Swimming. In entering the sea the elephant seal go down the beach and into the water in the usual land-progression manner, but, before the water is deep enough to cover them completely, they duck their heads under and start swimming with powerful strokes of their hind flippers: this soon carries them off into deeper water. The hind flippers only are used for swimming, the plantar surfaces being opposed and the webs more or less expanded according to the amount of speed required. If they are hurried the webs are widely expanded and very vigorously sculled from side to side. When floating on the surface in still water in the bays they like to bring the head and hind flippers above the water at the same time, but at sea they have only been observed with the head alone out of the water. They are able to stay under water for twelve minutes at least, the writer having timed a dive of this length, and in his opinion they are able to stop below longer than this without undue inconvenience. On the occasion of this twelve-minute dive, which was the longest timed, the seal did not appear to be short of breath when it reappeared, and it soon dived again. On other occasions, when seals have been driven into the water to find the duration of the dive, they have not returned to the surface within sight at all.

Colour. The colour of the pups after they have shed their first black woolly coats is silvery grey, darker dorsally and lighter ventrally. The new coat of the cows and small bulls is slightly darker in colour, sometimes tinged with yellow, and it gradually becomes darker until it is a grey brown by the time it is shed. The new coat of the big bulls is light grey brown and becomes darker like that of the cows and small bulls. In all it is darker dorsally than ventrally, and there are no markings. The new coats of the seal soon become stained a yellowish or greenish brown by the mixture of mud and bright orange faeces in the wallows. The colour of the coat also appears much lighter when one looks at it with the lie of the hair than when one looks at it against the lie.

Numbers at South Georgia. As to the number of seal which annually haul out at South Georgia, it is impossible to make any definite statement. In the writer's opinion there are at least one hundred thousand, at a very moderate estimate. In all the large bays there are extensive rookeries totalling several thousand for each one: Cumberland, St Andrews, Royal and Sandwich Bays; Gold Harbour and Cooper Bay; Drygalski Fjord and Annenkov Island; King Haakon and Queen Maud Bays; Wilson Harbour and Ice Fjord; Right Whale Bay; Possession, Fortuna and Antarctic Bays all have many large rookeries, and the smaller bays all round the coasts are each plentifully supplied, probably exceeding in numbers those of the larger bays. In addition, there are hundreds of small inaccessible coves and beaches between the bays and harbours, which all give shelter to their complement of seal, altogether certainly equalling the numbers of those in the accessible parts. Sealers and whalers with whom the writer has discussed the probable numbers of seal on the island think that the estimate given above is exceedingly cautious, and that a quarter of a million would be short of the true number.

Elephant Seal Oil Industry. Elephant seal hunting is now carried on in a style different from that of the sailing-ship days. In the old style elephant hunting was combined with fur sealing, until the extinction of the fur seal confined the business to oil hunting alone. The trade was in full swing by 1800, in which year the seventeen vessels at work in the island took 112,000 fur seal skins between them. Weddell stated that in 1823 the fur seal and elephant seal were nearly extinct, "not less than 20,000 tons of elephant oil having been shipped to the London market alone, and not less than 1,200,000 fur seal killed since the reports by Captain Cook in 1775 which led sealers to this island". Since then the island has been worked at various times by a few vessels, mostly American, right down to the present century, the last "old-timer" working in the season 1912–13. In the palmy days of the hunting the vessels would anchor in some safe harbour and build on shore, from materials they brought with them, one or more "shallops" to collect the skins and blubber from the various rookeries. Some of these tenders, built in South Georgia more than a century ago, were decked, cutter-rigged vessels, as big as thirty tons. Gangs of men were also put ashore with try-pots and casks at good beaches, where they built huts, sometimes even wintering, and carried on their occupation of killing the elephant seal and boiling out the oil and collecting fur seal skins. When sufficient oil and skins had been accumulated they were rafted off to the ships. In many bays of the island the try-work bricks and cast-iron try-pots of the old sealers are to be seen on the beaches, and at Wilson Harbour the remains of the walls of one of their huts can still be traced. When they had killed the seal with lance, club, or musket, the skin was removed and the blubber flensed off and soaked in sea-water for twenty-four hours to cleanse it. It was then minced and boiled out in large iron pots, the try-works being so arranged that after the first boiling the oil flowed over into another pot in which it was boiled a second time before running off into the casks. The scraps of blubber after they had been boiled were used for fuel. In later days the building of "shallops" was given up and the sealers sent

away their open boats to the various bays to carry and tow back the blubber for trying out on board the ship.

At the present day the hunting is carried on by one of the whaling companies, under a licence issued by the Government of the Falkland Islands. The first licence for taking seals was issued in 1910 and the same company has continued hunting until the present time. The coast of South Georgia is divided into four roughly equal divisions, of which only three are worked each year, the fourth forming an unmolested reserve. The licence allows the taking of adult bull seal only and stipulates that 10 per cent of the bulls shall be left on each beach. As the elephant seal is polygamous there are always many bachelor bulls on the beaches; further, it may be assumed that the proportions of the sexes born annually are about equal, so that the excess of bulls may well be exploited commercially without diminishing the numbers of the species; in fact the numbers may be increasing in spite of the hunting. The taking of seal is prohibited during the close season between November 1 and March 1. During the winter, from the beginning of May until the end of August sealing is impracticable owing to the absence of the seal, bad weather and the closing of the whaling station. Consequently the actual period during which the seal are taken is limited to the four months September and October, March and April. The licence requires the licensee to furnish an account of the number and kind of seals taken, and to report and locate on the chart where such seals were found in large numbers or rookeries, or where others were observed. The licence allowed also the taking of Weddell seal until 1916, since when this species has been protected. The taking of Leopard seal as well as Elephant seal is permitted, but the numbers taken annually are negligible, rarely exceeding one hundred.

Season	Elephant seals	Leopard seals	Weddell seals	Total	Barrels of oil
1910	2965	35	5	3005	3467
1911	1985	65	9	2059	4031
1912	2659	87	48	2794	5712
1913	4503	26	11	4540	7840
1914	3070	33	10	3113	4641
1915	2016	—	—	2016	2537
1916	2867	25	14	2906	5337
1917	2941	77	—	3018	5297
1918	2952	2	—	2954	6137
1919	1227	3	—	1230	1650
1920	1527	18	—	1545	2269
1921	1090	24	—	1114	1660
1922	2652	61	—	2713	5035
1923	2879	115	—	2994	6375
1924	3867	35	—	3902	7486
1925	3775	26	—	3801	6891
1926	4671	111	—	4782	8094
1927	5506	9	—	5515	10033

The above table shows the number of seal taken in the course of commercial operations since the year 1910.

For hunting an old whale-catcher is used, the crew being Norwegian and Russian. She visits the various beaches and anchors off them as near the shore as possible, and sends ashore a "pram" with the hunters (Plate XIX, fig. 1). The selected seal are driven down to the water's edge and there shot by rifle. The killing shots are the back of the head, or, if the seal stops to roar, as he frequently does, up through the palate into the brain while the mouth is widely open. When the seal is killed the iris of the eye relaxes so that the retina throws a green reflection. This fact was noted by Pernety in 1764, who says: "I remarked that when they were expiring their eyes changed colour, and their crystalline lens became of an admirable green". As the elephant seal, like all seals, is very tenacious of life, the sealers sever the carotids by gashing the side of the neck after the seal have been knocked down by the rifle shot. The quantity of blood that runs from a large elephant seal is very great, a fact which much impressed the early voyagers. The blubber is flensed off with the hide by cutting through it along each side just above the ground as the seal lies on his belly. These two cuts are joined by cuts across the head, and across the hind part of the body at the base of the hind flippers. A median cut is then made down the back, dividing the dorsal blubber into two equal parts. These are again divided by vertical cuts at the middle length of the body, and the four resulting flaps of blubber are quickly dissected off (Plate XXIV, fig. 3). The carcass is then rolled over on to its back and four similar pieces are flensed off the under surface. Long pointed knives are used for flensing: they are carried in locally made wooden sheaths hung from the belt and are kept very sharp by frequent application of the steel. The sealers take hold of the blubber by steel hooks similar to the stevedore's "cargo hooks". As the pieces of blubber are flensed off a cut is made in them so that they can be threaded on a rope, and then they are dragged into heaps at the water's edge. Whilst the killing and flensing are going on, the pram returns to the ship, and coils down a long rope, one end of which is made fast on board, whilst the other end is brought ashore, the coil in the pram being payed out the while. To the shore end of the rope a wire is made fast, having a number of smaller wires, each about a fathom long and ending in a wooden toggle, spliced into it at intervals. The toggles and wires are threaded through the pieces of blubber, which have cuts in them for the purpose, and when the wire is loaded the signal is given, and the rope is hove in to the ship by the steam winch, bringing with it the wire and its load of blubber. The flensed carcasses are left to rot on the beach and are soon reduced to clean picked skeletons by the birds, especially Giant Petrels, Gulls, Skuas and Sheathbills.

The shore gang return to the ship while the blubber is being hove on board and put in the hold; then the anchor is weighed and the next beach is visited. As the hold-space is not large on the whale-catchers the after rail is built in with planks and corrugated iron sheeting and a deck cargo is carried there as well. The blubber is brought back to the whaling station and is there minced and boiled out. During the best part of the season, given good weather, each whale-catcher employed brings in a full cargo, the blubber of a hundred to a hundred and thirty seals, every three days; but bad weather often delays them so that they cannot get home for a week or more.

The elephant seal are of extremely low intelligence, as the survivors take no notice at all of the slaughter of their companions. A slight disturbance is caused in the rookeries in driving the bulls out of the harems, which they are loth to leave, and down to the water; but as soon as the hunters have passed through the rookeries the seal all settle down again, and the spare bulls proceed to annex the harems and fight amongst themselves for them. The blood and carcasses, and the presence of the sealers cause no disturbance, nor does the sound of rifle fire, as it is possible to shoot many in succession right alongside each other. Sometimes the spare bulls get sufficiently scared to enter the water, but they do not go away and soon haul out again. The cows and pups take no notice whatever of the killing.

BIBLIOGRAPHY OF THE ELEPHANT SEAL

ABBOTT, C. C., 1868. *On Seals of the Falkland Islands.* Proc. Zool. Soc. London, 1868, p. 189.

ALLEN, J. A., 1880. *History of North American Pinnipeds.* U.S. Geological and Geographical Survey: Miscellaneous Publications, no. 12, pp. 743–7, figs. 57–60.

—— 1905. *The Mammalia of Southern Patagonia.* Reports of the Princeton University Expeditions to Patagonia, III (1), Zoology, pp. 16–18, 84–5, 94–9, 106–15 (Princeton).

ANDERSSON, K. A., 1905. *Das höhere Tierleben im Antarktischen Gebiete.* Wissenschaftliche Ergebnisse der schwedischen Südpolar-Expedition, V (2), pp. 16–19 (Stockholm).

ANSON, G., 1748. *A Voyage round the World in the years* 1740–44, p. 122, pl. 19 (London).

Anon. [J. MARA] 1775. *Journal of the Resolution's voyage in* 1772–75 *on Discovery to the Southern Hemisphere, by which the Non-Existance of an Undiscovered Continent between the Equator and the 50th Degree of Southern Latitude, is demonstrably proved, &c.*, p. 319, London: F. Newbery.

BARRETT-HAMILTON, G. E. H., 1901. *Seals.* The Antarctic Manual, pp. 209–24 (London).

—— 1902. *Report on the Collections of Natural History made during the voyage of the 'Southern Cross'*, I, *Mammalia*, pp. 1, 8 (London).

BLAINVILLE, H. M. D. DE, 1840. *Ostéographie des Mammifères: Des Phoques*, II (J), pp. 1–51; Atlas II, pls. 5, 9 (Paris).

BOYSON, V. F., 1924. *The Falkland Islands*, pp. 232–5, 243, pls. 20, 21 (Oxford).

BROOKES, J., 1828. *A Catalogue of the Anatomical and Zoological Museum of Joshua Brookes, Esq., F.R.S., F.L.S., etc.*, p. 36 (London).

BROWN, R. N. R., MOSSMAN, R. C. and PIRIE, J. H. H., 1906. *The Voyage of the 'Scotia,'* pp. 203–4, 261–2, 327 (Edinburgh).

BUFFON, G. L. L. DE, 1825. *Œuvres Complètes*, XVII, pp. 249–416 (Paris).

COOK, J., 1777. *A Voyage towards the South Pole and round the World*, II, p. 213 (London).

CUVIER, G. (Baron), 1823. *Recherches sur les Ossemens Fossiles*, V (1), pp. 212–14 (Paris).

CUVIER, M. F., 1824. *De quelques espèces de Phoques.* Mémoires du Muséum d'Histoire naturelle, XI, p. 200, pls. 13, 14, fig. 1 (Paris).

—— 1825. *Des Dents des Mammifères*, pp. 123–4, pl. 39 A (Paris).

DAMPIER, W., 1729. *A New Voyage round the World*, from A Collection of Voyages, I, pp. 90–1 (London).

DESMARET, M. A. G., 1820–2. *Mammalogie*, I, pp. 237–54 (part only). Encyclopédie méthodique (Paris).

DISTANT, W. L., 1899. *The 'Sea Elephant'* (Macrorhinus elephantinus). Zoologist, III (4), pp. 385–7 pl. III (London).

EATON, A. E., 1875. *"First Report of the Naturalist accompanying the Transit of Venus Expedition to Kerguelen's Island in* 1874" (Conclusion). Proc. Roy. Soc. XXIII, p. 502 (London).

FISCHER, J. B., 1829. *Synopsis Mammalia*, pp. 230, 235 (Stuttgardt).

FLOWER, W. H., 1881. *On the Elephant Seal*, Macrorhinus leoninus (*Linn.*). Proc. Zool. Soc. London, 1881, pp. 145–62, figs. 1, 2.

FORSTER, G., 1777. *A Voyage round the World*, II, p. 527 (London).

[GOODE, G. BROWN], CLARK, A. HOWARD, 1887. *The Seal and Sea Otter Industries.* 3. *The Antarctic Fur-Seal and Sea Elephant Industries.* The Fishery Industries of the United States, XVIII, Section 5, vol. II, p. 435; Section 5, Atlas, pls. 222–9 (Washington).

GRAY, J. E., and GRIFFITH, E., 1827. *Cuvier's Animal Kingdom.* Synopsis of the Species of the Class Mammalia, V, pp. 180, 184 (London).

GRAY, J. E., 1844. *Zoology of the voyage of H.M.S. 'Erebus' and 'Terror': Mammalia;* I. *Seals of the Southern Hemisphere*, I, pp. 4, 8, pls. 9, 10 (London).
—— 1847. *British Museum Catalogues: List of Osteological Specimens*, p. 33 (London).
—— 1850. *Catalogue of the Mammalia in the British Museum.* Part II. *Seals*, p. 34 (London).
—— 1866. *Catalogue of Seals and Whales in the British Museum*, p. 38, fig. 13 (London).
—— 1869. *The Sea Elephant* (Morunga proboscidea) *at the Falkland Islands.* Ann. Mag. Nat. Hist. III (4), p. 400 (London).
—— 1874. *Hand-List of Seals, Morses, Sea-Lions and Sea-Bears in the British Museum*, p. 34 (London).
HALL, R., 1900. *Sea-Elephants on Kerguelen's Land.* Zoologist, IV (4), p. 441, 1 fig.
[JARDINE, W.], HAMILTON, R., 1839. *The Naturalist's Library: Mammalia, Amphibious Carnivora,* VIII, pp. 207–27, pls. 16–17 (Edinburgh).
[KERR, R.], 1824. *A Voyage round the World,* by Captain Woodes Rogers and Stephen Courtney in 1708–11, from A Collection of Voyages, X, p. 354 (Edinburgh).
KIDDER, J. H., 1875. *Contributions to the Natural History of Kerguelen Island.* Bull. U.S. Nat. Mus. III, p. 39.
LAMBERT, J., 1818. *Tristan d'Acunha, etc.* Blackwood's Edinburgh Magazine, XXI (4), p. 283.
LANMAN, CH., 1879. *Hunting the Sea Elephant.* Forest and Stream, XI, pp. 437–8 (New York).
LINNAEUS, C., 1758. *Systema Naturae* (10th edition), I, p. 55 (Holmiae).
LÖNNBERG, E., 1906. *Contributions to the Fauna of South Georgia,* I. K. Svenska Vetensk. Akad. Handl. XL (5), pp. 9–16, pls. 3–4 (Uppsala and Stockholm).
—— 1910. *On the Variation of the Sea Elephants.* Proc. Zool. Soc. London, 1910, pp. 580–8.
LYDEKKER, R., 1909. *On the Skull Characters in the Southern Sea-Elephant.* Proc. Zool. Soc. London, 1909, pp. 600–6, 3 pls.
—— 1909. *The Sea Elephant of the Falklands.* The Field, CXIV, pp. 1172–3.
MAWSON, D., 1923. *Macquarie Island and its Future.* Australian Zool. III, pp. 92–102, pls. IX, XIV.
MOLINA, G. I., 1782. *Saggio sulla Storia naturale del Chili*, p. 280 (Bologna).
MOSELEY, H. N., 1879. *Notes by a Naturalist on the 'Challenger,'* pp. 114, 171, 187, 200, 201, 205, 222, 227, 3 figs. (London).
MURPHY, R. C., 1913. *A desolate Island of the Antarctic, South Georgia.* Amer. Mus. Journ. XIII, pp. 243–59.
—— 1914. *Notes on the Sea Elephant,* Mirounga leonina (*Linné*). Bull. Amer. Mus. Nat. Hist. XXXIII, pp. 63–79.
NILSSON, S. VON, 1837. *Utkast till en systematisk indehning af Phocacéerna.* K. Svenska Vetensk. Akad. Handl. 1837, pp. 235–40 (Stockholm).
—— 1841 [translated from the Swedish by W. Peters]. *Entwurf einer systematischen Eintheilung und speciellen Beschreibung der Phoken.* Arch. Naturgesch. VII (1), pp. 301–33.
OWEN, R., 1853. *Descriptive Catalogue of the Osteological Series contained in the Museum of the Royal College of Surgeons,* II, p. 638, no. 3920 (London).
PALLAS, P., 1811. *Zoographia Rosso-Asiatica,* I, p. 106 (Petropoli).
PARSONS, J., 1751. *A dissertation upon the Class of the Phocae marinae.* Phil. Trans. XLVII, p. 121.
PENNANT, T., 1771. *Synopsis of Quadrupeds*, pp. 348–51 (Chester).
PERNETY, 1771. *The History of a Voyage to the Malouine (or Falkland) Islands in* 1763 *and* 1764, pp. 188, 201, pl. XVI (London).
PÉRON, F. et FREYCINET, L. DE, 1824. *Voyages de Découvertes aux Terres Australes,* III, pp. 55–115, Atlas, pl. 62 (Paris).
PERON, M., 1827. *Account of the Hàbits of the Sea Elephant.* Edinburgh Journal of Science, VII, pp. 73–5.
PETERS, W., 1875. *Eine neue Art von Seebären,* Arctophoca gazella, *von den Kerguelen-Inseln.* Monatsberichte der Akademie der Wissenschaften zu Berlin, 1875, pp. 393–5.
POCHE, F., 1909. Macrorhinus *oder* Mirounga? Zool. Anz. XXXIV, p. 319.
POCOCK, R. I., 1911. *The Elephant Seal in the Zoological Gardens.* The Field, CXVII, p. 649.
Report of the Interdepartmental Committee on Research and Development in the Falkland Islands, pp. 16–18, 84, 106–15. Cmd. 657, 1920 (London).
RING, T. P. A., 1923. *The Elephant Seals of Kerguelen Land.* Proc. Zool. Soc. London, 1923, pp. 431–43.
RISTING, S., 1922. *Av Hvalfangstens Historie,* pp. 325, 448, 452 (Kristiania).
ROTHSCHILD, W., 1908. Mirounga angustirostris (*Gill*). Novit. Zool. XV, p. 393, pls. 1–8.
—— 1910. *Notes on Sea Elephants* (Mirounga). Novit. Zool. XVII, pp. 445–6, pls. 8, 9.
SCAMMON, C. M., 1874. *The Marine Mammals of the North Western Coast of North America,* pp. 115–23, pl. XX (San Francisco).
SCHREBER, J. C. D. VON, 1778. *Die Säugethiere in Abbildungen nach der Natur, mit Beschreibungen,* III, p. 297, fig. 83.
SCLATER, P. L., 1868. *On additions to the Society's Menagerie: and report on Lecomte's expedition to the Falkland Islands.* Proc. Zool. Soc. London, 1868, p. 527.

Scott, H. H., and Lord, C., 1929. *Notes on the Sea Elephant* (Mirounga leoninus). Papers and Proc. Roy. Soc. Tasmania, 1928, pp. 93–96, pls. x–xiv.

Scott, J. H., 1883. *Macquarie Island.* Trans. N.Z. Inst. xv, p. 492.

Shaw, G., 1800. *General Zoology*, I (2), pl. 73.

Steinen, K. von den, 1890. *Allgemeines über die zoologische Thätigkeit und Beobachtungen über das Leben der Robben und Vögel auf Süd-Georgien.* Die deutschen Expeditionen und ihre Ergebnisse, II, p. 208 (Berlin).

[Studer, Th.], 1889. *Die Forschungsreise S.M.S. 'Gazelle'*, III, p. 89 (Berlin).

Townsend, C. H., 1912. *The Northern Elephant Seal.* Zoologica, I (8), pp. 159–73, pls. 52–72 (New York).

Turner, W., 1888. *Report on the Seals collected during the Voyage of H.M.S. 'Challenger' in the years* 1873–76, xxvi, pp. 3, 69, pls. I–IV (London).

Vallentin, R., 1900. *Notes by a Naturalist on his voyage to the Falklands and back, with remarks on the fauna and flora of those islands.* Journal of the Royal Institution of Cornwall, xiv, pp. 339–64, 1 fig. (Truro).

Wagler, J., 1830. *Natürliches System der Amphibien mit vorangehender Classification der Säugethiere und Vögel*, p. 27 (München, Stuttgart und Tübingen).

Weddell, J., 1825. *A Voyage towards the South Pole*, pp. 83–4, 134 (London).

Wilson, E. A., 1907. *Mammalia: Cetacea.* National Antarctic Expedition, 1901–4. Natural History, vol. II, Zoology, pp. 51–9, 1 pl. (London).

Woodes Rogers, 1712. *A cruising Voyage round the World*, p. 136 (London).

NOTES ON OTHER SEALS FOUND AT SOUTH GEORGIA

The following notes comprise the observations made in South Georgia on seals other than the elephant seal. The species concerned are the Weddell and Crab-eater Seals, the Leopard Seal, and the Fur Seal. With the exception of the Leopard Seal the life histories of these seals have been thoroughly worked out by the members of previous antarctic expeditions[1], and these notes merely concern the occurrence of those species in South Georgia.

Weddell Seal, *Leptonychotes weddelli*, Less.

This seal, called by the Norwegian whalers and sealers "Fisk Sael", is found constantly, though in small numbers, at South Georgia. At Larsen Harbour, in Drygalski Fjord, at the southern extremity of the island, there is a small colony of them which make this place their home and they are always to be found there. In the other bays odd ones are occasionally seen. The headquarters of the species is amongst the ice further south.

There are between twenty and thirty Weddell seals in Larsen Harbour, and their pups are born in January. The sides of this harbour are very high and precipitous and the seals live on the narrow beaches at the water's edge. In November 1925 the writer found them lying about sleeping on the beaches and the level snow behind them, and the skeletons of several pups were found. One young one of the previous season hauled out at the whaling station in Grytviken in June 1925. It was about 5 ft. long. It came ashore one evening and spent the night asleep on the beach, returning to the sea early the next morning. It took no notice of the presence of men, but if touched it raised its head and snapped its jaws. In breathing it made a shrill whistling sound at each expiration: maybe it was sick. Another one, an old female in pup, was seen in Else Cove in September 1925. It was very fat and was lying on its back on the snow well back from the beach. When approached it made a whistling noise and snapped its jaws and then made a rattling sound by rapidly vibrating them. The Weddell seals are not molested by the sealers now, though until 1917 the sealing licences allowed the taking of this species, the catch of which averaged less than fourteen annually from 1910–1916 inclusive.

[1] For literature on these seals see Barrett-Hamilton, '*Southern Cross*' *Collections*, p. 1, pl. 1 (1902); Wilson, *ibid.* p. 67, pls. II–VI; Hansen, *ibid.* p. 84; Wilson, *Nat. Antarct. Exped.* 1901–4, II, p. 10, pls. I, II (1907); Tims, *ibid.* V, p. 1, pls. I, II (1907); Trouessart, *Expéd. Antarct. Française—Mammifères Pinnipèdes* (1907); *Scottish Nat. Antarct. Exped.* IV (1915); Barrett-Hamilton, *Expéd. Antarct. Belge*, IX, no. 4 (1901–4); Andersson, *Wiss. Ergebn. Schwedischen Sudpolar Exped.* V, no. 2 (1908).

Crab-eater Seal, *Lobodon carcinophagus*, Jaquinot & Pucheran.

Three or four were seen in Larsen Harbour near the Weddell seals in November 1925. They were lying on the snow near the water and were sluggish in their movements, but made for the sea when disturbed. The colour of their hair was reddish white. They were not heard to utter any sound when irritated, but they vibrated their jaws in the same manner as the Weddell seal. In December 1926 and January 1927 the skeletons of three Crab-eaters were found in Stromness Bay, one in Husvik Harbour and two in Stromness Harbour. They were all near the beach and had evidently hauled out and died during the previous winter. They were all adult. Though the true home of this species is among the ice-pack far to the south, it will thus be seen that occasional stragglers reach South Georgia, this island probably being at the northern limit of its range in these regions, though further west it has been recorded from Patagonia and Rio de la Plata[1].

Leopard Seal, *Hydrurga leptonyx*, Blain.

The Leopard Seal is a constant inhabitant of South Georgia, and though it is never found congregated in rookeries, it may be said to be common. Near the whaling station in Grytviken it is only found in the winter, but by taking a trip on one of the sealing boats one finds that odd ones are always to be seen in most of the bays and fjords. It is a solitary animal at all times, even when breeding; the largest number that was seen at once on a small stretch of beach was six, and in no sense could this collection be called a rookery as the seal were not lying close together. On the land they haul out on to the beaches, but do not go up on to the tussac-covered ground behind, as do the elephant seal. In moving on the land they wriggle along by arching the back and pushing themselves along from the pelvic region of the body; the fore flippers are not used and are kept closely pressed to the sides of the body. If they are approached while they are asleep, they wake up and menace the intruder by widely opening the jaws and snapping them. If they are further irritated they make a peculiar throbbing sound in the throat; this is not produced by the vocal cords, but by expelling the air in short jerks through the glottis. Frequently they will make for the intruder without provocation before he approaches closely, but if he steps back they will not follow him. They are surprisingly nimble in their movements on land and have a peculiar snake-like appearance. In spite of their ferocity when first approached, they soon get scared and make for the water, voiding the contents of the bladder and rectum as they go.

In the water they are extremely graceful, being lithe and active in all their movements. They are very inquisitive and will approach close to a boat to inspect it. If they are in the neighbourhood they can be attracted to a boat by gently hammering or tapping regularly on the gunwale or thwart.

Leopard seal are to be seen in Cumberland Bay much more commonly in the winter than in the summer. They come in especially when the bay is filled with ice from the

[1] Rudmose Brown, *Scottish Nat. Antarct. Exped.* IV, p. 194 (1915).

Nordenskjold glacier and can then be seen asleep on the floes. In the winter, too, they haunt the patch of kelp off the Marine Biological Station on King Edward Point, and can be seen bringing to the surface and devouring the fish which they catch there. In getting on to the ice floes they take astonishing leaps from the water, suddenly shooting out to a height of 6 ft., after first reconnoitring the place where they are going to land. In 1926 the Resident Magistrate, Mr E. Binney, showed the writer a photograph of a leopard seal that had jumped out of the water on to the back of a dead whale as it lay alongside the jetty of the whaling station.

The food of the leopard seal consists mainly of fish and penguins. As stated above, the members of the 'Discovery' staff often watched them catching fish off the Marine Biological Station during the winter. The stomach of one examined at Else Bay in September 1925 was full of small pieces of blubber, though digestion was too far advanced to be able to determine whether it was from seal or penguin. Leopard seal are always to be seen cruising about in the water at the places where the penguins land to go to their rookeries, and they take heavy toll of them. In eating a penguin the seal brings it to the surface and shakes it as a dog does a rat, and then, holding it by the belly, continues shaking until the skin is completely inverted. It then eats the carcass, discarding the skin and feathers. They have also been observed eating penguins at sea away from the rookeries. On one occasion one was seen to come up underneath a Giant Petrel that was swimming on the water and drag it down. The seal brought it to the surface when it was half drowned and devoured it after skinning it in the manner described above. When the sealers are rafting off the elephant-seal blubber to their ship a leopard seal will often follow them, biting large lumps out of the floating blubber and twisting and turning around in the water to detach them.

The young of the leopard seal are born in late August and early September. The females come ashore to give birth and are always strictly solitary. A foetus 3 ft. long was taken from a large female killed near King Edward Point in July 1925. In September 1925 a young one $3\frac{1}{2}$ ft. long was seen at Else Bay. It was lying on the beach near two females, neither of which appeared to take any interest in it. It was very tame, merely lifting up its head to look at us when we approached and not showing its teeth. It seemed to be very weak and feeble, having a thin body and disproportionately large head that appeared almost too heavy for its neck to support, for it wavered from side to side when it was raised. During November and December young ones from 6 to 7 ft. long are frequently to be seen on the beaches, having then left their parents. The young at this age make a loud shrill cry much like the noise of a ship's steam siren, and so remarkable is this likeness that on one occasion on hearing it during the night the people on King Edward Point turned out to see what ship was coming in. The young grow very rapidly, but are not mature for at least a year: the skull of one 9 ft. long, evidently born in the previous spring, killed at Grytviken in June 1925, still had the parietal foramen unclosed and $\frac{3}{8}$ in. in diameter.

The females are much bigger than the males, growing to 14 ft. long, whilst the length of a full-grown male is about 10 ft.

The flesh of the leopard seal is very good eating and was always a welcome addition to our larder during the winter. The brains, tongue, heart and liver are the best parts.

No information was collected as to the pairing habits or period of gestation of the leopard seal owing to its solitary and wandering mode of life.

The sealing licences allow the taking of leopard seal, and the annual catch is usually between fifty and one hundred. The blubber is not thick enough to produce much oil; neither does the price realised pay for preserving the skins, so that this species is not of particular interest to the sealer. It has been stated[1] that the leopard seal is a "ferocious pest, which preys on penguins as well as fish, and any diminution in its numbers may, perhaps, be viewed with equanimity". No reason is given for preferring penguins or fish to leopard seal.

Fur Seal, *Arctocephalus australis*, Zimm.

This species was formerly numerous in South Georgia, but is now practically extinct. In 1822 Weddell calculated that not less than 1,200,000 fur-seal skins had been taken there since 1775 and stated that they were then almost extinct. In 1874[2] 1450 skins were taken, 600 in 1875 and 110 in 1876. One fur seal was seen in 1885 or 1886 and three were taken in 1887. In 1892, 135 were taken. In 1905 a sealing-vessel could find none, but a few were taken in 1907. Larsen[3] states that 170 were caught in 1906, and 30 were seen together in 1911. Since then a few scattered examples have been seen, the latest being two on Willis Island in 1927.

[1] *Report of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands*, Cmd. 657, p. 17, 1920.

[2] D. S. Jordan, *Fur Seals of the Pribilof Islands*, III, p. 307, Washington, 1899.

[3] *Loc. cit. supra*, 1920, p. 92.

PLATES XIX–XXIV

PLATE XIX

Fig. 1. General view of an Elephant seal rookery. Bachelor bulls are scattered on the landward side of the rookery. A sealing vessel lies in the bay and a group of sealers is flensing half-way along the beach.

Fig. 2. General view in an Elephant seal rookery, showing the crowded state of the beach.

A. Saunders phot.

Fig. 1.

A. Saunders phot.

Fig. 2

ELEPHANT SEAL OF SOUTH GEORGIA

PLATE XX

Fig. 1. A newly born Elephant seal pup and its mother. A portion of the attached umbilical cord can be seen below the abdomen of the pup.

Fig. 2. A cow suckling her pup. She is lying on her side while the pup suckles at the lower nipple; the upper one can be seen as a dark spot above the pup's nose.

A. Saunders phot.

Fig. 1.

A. Saunders phot.

Fig. 2.

ELEPHANT SEAL OF SOUTH GEORGIA

PLATE XXI

Fig. 1. A small harem of Elephant seal, a bull with four cows and their pups. A bachelor bull watches the harem from the water. The backs of the cows and pups are sprinkled with the sand thrown up. The head and neck of the central cow show well the light-coloured scars caused by the bites of the bull, while the neck and back of the bull are covered with the scars of wounds received in fighting. Notice the wet patch on the side of the bull's face, due to tears streaming from the eye.

Fig. 2. Elephant seal pups herding on the beach after leaving their mothers.

Fig. 3. A bull Elephant seal roaring, with the proboscis inflated. Compare with Plate XXII, fig. 1.

F. Hurley phot.

Fig. 1.

L. H. Matthews phot.

Fig. 2.

L. H. Matthews phot.

Fig. 3.

ELEPHANT SEAL OF SOUTH GEORGIA

PLATE XXII

Fig. 1. A sleepy bull Elephant seal, with the proboscis not inflated.

Fig. 2. An enraged bull Elephant seal roaring and rearing up on the hind part of the body.

Fig. 3. Two bull Elephant seal fighting.

A. Saunders phot.

Fig. 1.

A. Saunders phot.

Fig. 2.

A. Saunders phot.

Fig. 3.

ELEPHANT SEAL OF SOUTH GEORGIA

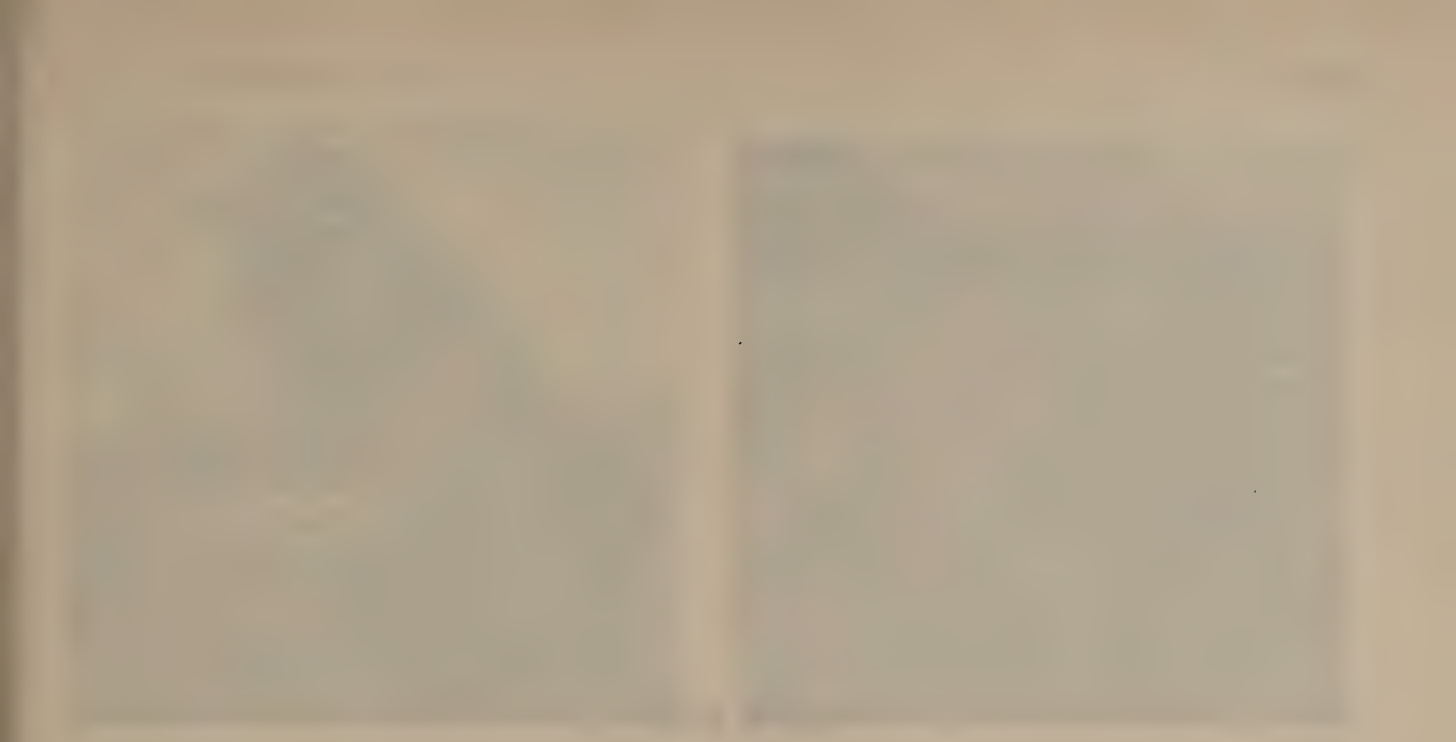


PLATE XXIII

Fig. 1. A moulting bull Elephant seal. Notice the old hair coming off in patches.

Fig. 2. A moulting bull Elephant seal. The proboscis is not yet fully developed, as this is a young full-grown bull, three or four years old. Notice the bare skin left where the sheets of old hair have peeled off, and the stream of tears flowing from the eye.

Fig. 3. A cow Elephant seal breathing through one nostril only.

F. Hurley phot.

Fig. 1.

F. Hurley phot.

Fig. 2.

A. Saunders phot.

Fig. 3.

ELEPHANT SEAL OF SOUTH GEORGIA

PLATE XXIV

Fig. 1. Elephant seal pups that have sunk into a depression in the snow, melted by the heat of their bodies.

Fig. 2. A cow Elephant seal calling to her pup.

Fig. 3. Sealers flensing an Elephant seal. The dorsal blubber has been divided into four pieces, of which the first is being peeled off. This photograph shows the thickness of the blubber. The sealing vessel lies at anchor off the beach.

A. Saunders phot.

Fig. 1.

L. H. Matthews phot.

Fig. 2.

L. H. Matthews phot.

Fig. 3.

ELEPHANT SEAL OF SOUTH GEORGIA

LIBRARY
PORT
FISH & WILDLIFE
SERVICE

Oahu Prison
Bird